ANNUAL REPORT

OF THE

OPERATIONS

OF THE

UNITED STATES LIFE-SAVING SERVICE

FOR THE

FISCAL YEAR ENDING JUNE 30, 1878.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1878.

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ORGANIZATION

OF THE

UNITED STATES LIFE-SAVING SERVICE.

(In conformity to act of Congress approved June 18, 1878.)

SUMNER I. KIMBALL, General Superintendent.
WILLIAM D. O'CONNOR, Assistant General Superintendent.

CAPT. JAMES H. MERRYMAN, United States Revenue Marine, Inspector of Life-Saving Stations.

CAPT. JOHN MCGOWAN, United States Revenue Marine, } Superintendents of Construction of Life-
CAPT. JAMES H. MERRYMAN, United States Revenue Marine, } Saving Stations.

ASSISTANT INSPECTORS.

First District.—CAPT. DANIEL B. HODGSDON, United States Revenue Marine, Portland, Maine.
Second District.—CAPT. ERIC GABRIELSON, United States Revenue Marine, Boston, Massachusetts.
Third District.—LIEUT. CHARLES H. MCLELLAN, United States Revenue Marine, Bay Shore, New York.
Fourth District.—LIEUT. WILLIAM C. DE HART, United States Revenue Marine, Tom's River, New Jersey.
Fifth District.—LIEUT. WILLIAM J. HERRING, United States Revenue Marine, Chincoteague, Virginia.
Sixth District.—LIEUT. WALTER WALTON, United States Revenue Marine, Manteo, North Carolina.
Seventh District.—CAPT. RUSSELL GLOVER, United States Revenue Marine, Key West, Florida.
Ninth District.—CAPT. JOHN CARSON, United States Revenue Marine, Oswego, New York.
Tenth District.—CAPT. GEORGE R. SLICER, United States Revenue Marine, Detroit, Michigan.
Eleventh District.—CAPT. DAVID EVANS, United States Revenue Marine, Milwaukee, Wisconsin.
Twelfth District.—CAPT. JOHN W. WHITE, United States Revenue Marine, Alameda, California.

LIEUT. CHARLES F. SHOEMAKER, United States Revenue Marine, on special duty, Washington, D. C.
LIEUT. THOMAS D. WALKER, United States Revenue Marine, on special duty, New York City.

DISTRICT SUPERINTENDENTS.

First District.—JOHN M. RICHARDSON, Auburn, Maine.
Second District.—BENJAMIN C. SPARROW, East Orleans, Massachusetts.
Third District.—HENRY E. HUNTTING, Bridgehampton, New York.
Fourth District.—JOHN G. W. HAVENS, Bricksburg, New Jersey.
Fifth District.—BENJAMIN S. RICH, Onancock, Virginia.
Sixth District.—JOSEPH W. ETHERIDGE, Manteo, North Carolina.
Seventh District.—WILLIAM H. HUNT, Biscayne, Florida.
Ninth District.—DAVID P. DOBBINS, Buffalo, New York.
Tenth District.—JOSEPH SAWYER, Detroit, Michigan.
Eleventh District.—WILLIAM R. LOUTTIT, Grand Haven, Michigan.
Twelfth District.—CAPT. JOHN W. WHITE, United States Revenue Marine, (Acting,) Alameda, California.

ASSISTANT DISTRICT SUPERINTENDENT.

Third District.—NICHOLAS BALL, New Shoreham, Rhode Island.

LETTER OF TRANSMITTAL.

TREASURY DEPARTMENT,
UNITED STATES LIFE-SAVING SERVICE,
Washington, D. C., November 30, 1878.

SIR: I have the honor to submit the following report of the operations of the Life-Saving Service for the fiscal year ending June 30, 1878, and of the expenditures of the moneys appropriated for the maintenance of the service for that period, in accordance with the requirements of section 7 of the act of June 18, 1878.

A compilation of the statistics of wrecks and casualties which have occurred on or near the coasts and on the rivers of the United States, and to American vessels at sea or on the coasts of foreign countries, collected under the authority of the act of June 20, 1874, is included.

I have the honor to be, very respectfully,

SUMNER I. KIMBALL,
General Superintendent.

Hon. JOHN SHERMAN,
Secretary of the Treasury.

OPERATIONS

OF THE

UNITED STATES LIFE-SAVING SERVICE.

1878.

REPORT

OF THE

UNITED STATES LIFE-SAVING SERVICE.

OPERATIONS.

At the close of the last fiscal year the life-saving establishment embraced 148 stations, distributed upon the sea and lake coasts, as follows:

District No. 1 (coast of Maine and New Hampshire)	6
District No. 2 (coast of Massachusetts)	14
District No. 3 (coast of Rhode Island and Long Island)	36
District No. 4 (coast of New Jersey)	39
District No. 5 (coast from Cape Henlopen to Cape Charles)	6
District No. 6 (coast from Cape Henry to Cape Hatteras)	10
District No. 7 (eastern coast of Florida)	5
District No. 8 (Lakes Erie and Ontario) *	9
District No. 9 (Lakes Huron and Superior)	9
District No. 10 (Lake Michigan)	12
District No. 11 (Pacific coast)	2

Nineteen of the foregoing are life-boat stations, situated, six in District No. 8, one in District No. 9, nine in District No. 10, and three in District No. 11.

Five others, those in District No. 7, are houses of refuge.

The life-boat stations, with one exception (at Thunder Bay Island, where the employment of an expert crew was absolutely indispensable), were dependent upon the volunteer system.

Three of these stations were new ones, first opened for service at the following dates:

One in District No. 8 (at Buffalo), September 19, 1877.

Two in District No. 11 (at Shoalwater Bay and Cape Disappointment), November 26, 1877, and February 15, 1878, respectively.

The houses of refuge are located upon the eastern coast of Florida, and, as the name implies, are simply designed to shelter and succor persons who are cast ashore in that desolate locality. They are conducted by keepers only, who are required to patrol the coast immediately after a storm for the discovery of persons in need of such relief. Regular crews of surfmen were employed only at the life-saving stations, with

* The numbers of this and the three following districts are changed by the recent renumeration, which will be found on page 129.

the single exception named, and the periods of their employment are shown in the following statement:

Employment of surfmen, season of 1877-'78.

District—	Number of stations.	Number of surfmen.	Period of employment.
No. 1	6	36	Nov. 1, 1877, to April 30, 1878, inclusive.
No. 2	4	24	Nov. 1, 1877, to April 30, 1878, inclusive.
	10	60	Nov. 1, 1877, to April 15, 1878, inclusive.
No. 3	7	42	Nov. 15, 1877, to April 15, 1878, inclusive.
	27	162	Nov. 15, 1877, to Mar. 31, 1878, inclusive.
No. 4	6	36	Nov. 15, 1877, to April 15, 1878, inclusive.
	31	186	Nov. 15, 1877, to Mar. 31, 1878, inclusive.
No. 5	8	48	Dec. 1, 1877, to Mar. 31, 1878, inclusive.
No. 6	10	60	Dec. 1, 1877, to Mar. 31, 1878, inclusive.
No. 8	3	18	Sept. 1, 1877, to Dec. 15, 1877, inclusive.
	3	18	April 1, 1878, to May 31, 1878, inclusive.
No. 9	5	32	Sept. 1, 1877, to Dec. 15, 1877, inclusive.
	5	32	April 1, 1878, to May 31, 1878, inclusive.
	4	24	July 1, 1877, to Nov. 24, 1877, inclusive.
	4	24	May 15, 1878, to June 30, 1878, inclusive.
No. 10	3	18	Sept. 1, 1877, to Nov. 30, 1877, inclusive.
	3	18	April 1, 1878, to May 31, 1878, inclusive.

The periods of employment of surfmen at the stations, of course, indicate the periods during which the stations are open and manned. The crews also render service at wrecks occurring at other times, where they can be summoned together for the purpose, but in many sparsely populated sections, where the stations are located several miles from settlements, it is impossible to seasonably collect them.

STATISTICS.

It appears from the reports of the officers of the several districts that there have been during the year, within the limits of the operations of the service, 171 disasters to vessels. There were on board these vessels 1,557 persons. The estimated value of the vessels is $1,879,063, and that of their cargoes $745,672, making a total value of the property involved $2,624,735. The number of lives saved was 1,331, and the number lost 226. Of the latter number 183 perished in the disasters to the United States steamer Huron and the steamship Metropolis—98 in the former and 85 in the latter. The number of shipwrecked persons sheltered and succored at the stations during the year was 423; the total number of days' relief afforded them being 849. The total value of property saved is estimated at $1.097,375, and the amount lost at $1,527,360. The number of disasters involving the total loss of vessels and cargoes was 59. The surf-boat was used 114 times, 189 trips being made with it; the self-righting and self-bailing life-boat 14 times, 18 trips being made. The breeches-buoy was employed twice, making 9 passages. The mortar was used on 10 occasions, 27 shots being fired. On one occasion the Merriman or Paul Boyton life-suit was used, and the heaving-stick was thrown once. On different occasions many persons were drawn ashore by hand, or by lines thrown to them.

The apportionment of the foregoing statistics to the several districts is as follows:

District No. 1.

Number of disasters	32
Value of vessels	$163,450
Value of cargoes	$41,778
Total value of property	$205,228
Number of persons on board vessels	185
Number of persons saved	183
Number of persons lost	2
Number of shipwrecked persons sheltered at stations	12
Number of days' shelter afforded	48
Value of property saved	$107,010
Value of property lost	$98,218
Number of disasters involving total loss of vessels and cargoes	7

District No. 2.

Number of disasters	20
Value of vessels	$77,056
Value of cargoes	$16,983
Total value of property	$94,039
Number of persons on board vessels	121
Number of persons saved	102
Number of persons lost	19
Number of shipwrecked persons sheltered at stations	59
Number of days' shelter afforded	96
Value of property saved	$24,504
Value of property lost	$69,535
Number of disasters involving total loss of vessels and cargoes	10

District No. 3.

Number of disasters	16
Value of vessels	$240,700
Value of cargoes	$139,770
Total value of property	$380,470
Number of persons on board vessels	162
Number of persons saved	162
Number of persons lost	None.
Number of shipwrecked persons sheltered at stations	90
Number of days' shelter afforded	235
Value of property saved	$148,275
Value of property lost	$232,195
Number of disasters involving total loss of vessels and cargoes	8

District No. 4.

Number of disasters	35
Value of vessels	$428,275
Value of cargoes	$121,948
Total value of property	$550,223
Number of persons on board vessels	244
Number of persons saved	244
Number of persons lost	None.
Number of shipwrecked persons sheltered at stations	73
Number of days' shelter afforded	182
Value of property saved	$342,688
Value of property lost	$207,535
Number of disasters involving total loss of vessels and cargoes	10

District No. 5.

Number of disasters	18
Value of vessels	$159,400
Value of cargoes	$240,900
Total value of property	$400,300
Number of persons on board vessels	147
Number of persons saved	140
Number of persons lost	7
Number of shipwrecked persons sheltered at stations	36
Number of days' shelter afforded	120
Value of property saved	$278,200
Value of property lost	$122,100
Number of disasters involving total loss of vessels and cargoes	9

District No. 6.

Number of disasters	9
Value of vessels	$517,692
Value of cargoes	$69,000
Total value of property	$586,692
Number of persons on board vessels	466
Number of persons saved	283
Number of persons lost	183
Number of shipwrecked persons sheltered at stations	132
Number of days' shelter afforded	136
Value of property saved	$28,000
Value of property lost	$558,692
Number of disasters involving total loss of vessels and cargoes	4

District No. 7.

Number of disasters	2
Value of vessels	$90,000
Value of cargoes	$12,500
Total value of property	$102,500
Number of persons on board vessels	36
Number of persons saved	36
Number of persons lost	None.
Number of shipwrecked persons sheltered at stations	None.
Number of days' shelter afforded	None.
Value of property saved	None.
Value of property lost	$102,500
Number of disasters involving total loss of vessels and cargoes	2

District No. 8.

Number of disasters	24
Value of vessels	$84,190
Value of cargoes	$58,019
Total value of property	$142,209
Number of persons on board vessels	102
Number of persons saved	102
Number of persons lost	None.
Number of shipwrecked persons sheltered at stations	8
Number of days' shelter afforded	9
Value of property saved	$78,874
Value of property lost	$63,335
Number of disasters involving total loss of vessels and cargoes	3

District No. 9.

Number of disasters	8
Value of vessels	$82,000
Value of cargoes	$32,324
Total value of property	$114,324
Number of persons on board vessels	57
Number of persons saved	52
Number of persons lost	5
Number of shipwrecked persons sheltered at stations	9
Number of days' shelter afforded	9
Value of property saved	$80,224
Value of property lost	$34,100
Number of disasters involving total loss of vessels and cargoes	2

District No. 10.

Number of disasters	7
Value of vessels	$36,300
Value of cargoes	$12,450
Total value of property	$48,750
Number of persons on board vessels	37
Number of persons saved	27
Number of persons lost	10
Number of shipwrecked persons sheltered at stations	4
Number of days' shelter afforded	14
Value of property saved	$9,600
Value of property lost	$39,150
Number of disasters involving total loss of vessels and cargoes	4

District No. 11.

No wrecks are reported as having occurred in this district within the limits of the operations of the stations between the time of their opening and the close of the fiscal year.

REMARKS ON STATISTICS.

These statistics show that the disasters of the past year have been greater in number and severer in character than the service has ever before encountered; a fact established by the record of 171 disasters within life-saving limits, against 134, the highest number of any former year, and of 59 vessels and cargoes totally lost, in contrast with the highest antecedent record of 34. A large proportion of the loss of life is made up, as before stated, of the 183 persons who perished at the wrecks of the Huron and Metropolis, the first wreck occurring before the opening of the stations under the provisions of law, and the latter between two stations, at such a distance from either as to greatly hinder successful operations; conditions which had long been indicated by the officers in charge of the service as pregnant with fatality. There are four other wrecks, involving the loss of ten lives, which occurred when the stations were closed, and one other disaster, involving the loss of four lives, happened at a distance which made prompt assistance impossible.

It is evident that the Life-Saving Service would be entirely justified in excluding from its accountability all losses which took place at sea-

sons during which the stations were not kept open for service, and also those which occurred at such distances from the stations as to make swift and efficient action on the part of their crews out of the question. Although there have been repeated instances in which, actuated by the desire to save life, the agents of the establishment have wrought outside of the appointed seasons of station-service or laboriously traveled great stretches of coast to render aid at distant wrecks, no one will pretend to claim that what they did as a human duty should be exacted of them as a legal obligation. This especially appears in the class of cases which involves the element of distance. The scheme of the service upon our beaches, framed with reference to its efficiency, contemplates about two and a half miles on either side of a station as the scope of its patrol. Within this beat of five miles the crews can be reasonably expected to keep the required watch for endangered vessels and to operate for the deliverance of those on board, and they can, therefore, be justly held accountable for their action in these limits; but on the Virginia and North Carolina coasts, during the past year as for some time previous, the distances between the stations were from 10 to 12 miles and in some cases 16, and although as a matter of necessity, imposed by the interests of humanity, these great spaces were patrolled as well as possible and zealously traveled whenever occasions of disaster required, it must be steadily remembered that this was done as a gratuitous concession to the hard circumstances of the case, and it would be preposterous to expect from the crews of such localities, toiling under conditions so adverse as these, a service as rapid and effectual at scenes of shipwreck as their comrades could achieve under more favorable auspices on the coasts of New Jersey or Cape Cod, while it would be no less unjust to demand it of them. The expectations of service at cases like that of the Frank Jameson or the Huron, where the station crews were not on duty, or like that of the Metropolis, where the station was very remote from the scene of the disaster, must, therefore, be moderated, and on every consideration of justice, and with reference to the sound rule that impossibilities are required of no one, such cases, as has been already observed, might be properly excluded from the class of those in which the Life-Saving Service is responsible.

Leaving such as these, accordingly, out of the account, there remain 29 lives which have been lost fairly and legitimately within the scope of the effective operations of the service. The circumstances attending this loss are hereinafter related, and show that in every instance the Life-Saving Service was blameless. Notwithstanding the uncommon violence of the tempests, occasioning worse wrecks than usual, the death-rate in proportion to the number of disasters and the number of persons on board the vessels involved, is smaller than is exhibited by the record of any previous year since the extension of the service under the authority of the act of June 20, 1874. The loss of life during the past year averages one to every 6 disasters, and one to every 39 persons exposed, against a pre-

vious average since the extension referred to, of one to every 4 disasters, and one to every 36 persons exposed.

The subjoined table gives a summary of results in the field of life-saving operations for the last seven years, the period since the introduction of the present system.

GENERAL SUMMARY

Of disasters which have occurred within the scope of life-saving operations, from November 1, 1871 (*date of introduction of present system*), *to close of fiscal year ending June* 30, 1878.*

Total number of disasters	578
Total value of vessels	$8,800,457
Total value of cargoes	$4,957,684
Total value of property saved	$8,065,322
Total value of property lost	$5,656,819
Total number of persons on vessels	6,287
Total number of persons saved	5,981
Total number of lives lost	306†
Total number of persons sheltered	1,382
Total number of days' shelter afforded	3,716

LOSS OF LIFE.

The past year has been singularly fruitful of varied disaster. One might say that a wave of catastrophe had swept over the world. The worst horrors of war were realized in the snowy passes of the Balkans. In India multitudes of people perished of famine. Famine, ending in cannibalism, devastated China. In this country a season of violent alternations of heat and cold, and of torrent rains and tornadoes, was succeeded by the ravages of yellow fever at the South. The marine disasters have been no less startling and colossal. In the British Channel the Eurydice, man-of-war, under full sail and not far from land, was thrown down in an instant by a snow-squall, and sunk with nearly every one on board. Later, there was the frightful collision of two German iron-clads, the Grosser Kurfürst and the König Wilhelm, involving hundreds of lives. A still greater number perished subsequently in the Thames, when the excursion boat, the Princess Alice, was run down by a huge collier, the Bywell Castle. On our own shores there have been two great shipwrecks, those of the Huron and the Metropolis. It is little wonder, therefore, that amidst all this prevalent calamity the record of

* It should be observed that the operations of the service during this period have been limited as follows: Season of 1871-'72, to the coast of Long Island and New Jersey; seasons of 1872-'74, to the coasts of Cape Cod, Long Island, and New Jersey; season of 1874-'75, to the coasts of New England, Long Island, New Jersey, and coast from Cape Henry to Cape Hatteras; season of 1875-'76, coasts of New England, Long Island, New Jersey, coast from Cape Henlopen to Cape Charles, and coast from Cape Henry to Cape Hatteras; season of 1876-'77, all the foregoing, with the addition of Florida and the Lake coast; and season of 1877-'78, as shown on page 11.

† One hundred and eighty-three of these were lost at the disasters of the steamers Huron and Metropolis, and 14 others when service was impeded by distance, or when stations were not open.

the Life-Saving Service should bear a larger death-rate than usual. Investigation of the circumstances of each successive disaster, made in accordance with the custom of the establishment where loss of life is involved, leads, however, to the gratifying conclusion that in no instance can blame be justly attached to the Life-Saving Service or its crews, as the following detailed statement of each wreck in the order of occurrence will show.

WRECK OF THE LAKE FOREST.

The first shipwreck of the year, within the scope of life-saving operations, which involved loss of life, was that of the schooner Lake Forest, bound from Buffalo to Chicago, which struck upon a reef one mile south of North Point, Lake Michigan, on the 10th of October, 1877, at half past eleven o'clock in the morning, during an easterly gale and fog, and in a heavy sea. The wreck was discovered by Keeper J. S. Matthews, of Life-Saving Station No. 4 (Thunder Bay Island), who at once started to her assistance with the life-boat and a crew of eight men. By the time he reached her the schooner had jumped the reef and anchored, leaking badly, her rudder carried away, her sails split, and bulwarks stove in, one of the ten men on board killed by the falling of the fore-boom, the other nine completely exhausted, and the vessel already in a sinking condition, so that the first thing done by the life-boat crew was to relieve the men at the pumps to keep her from going down.

Shortly afterward the captain of the schooner was taken on board the life-boat, and started for Alpena, about five miles distant, to procure a tug and the services of fresh men to save his vessel. On the way the schooner J. B. Kitchen was observed, four miles distant, flying signals of distress, being, as was afterward discovered, in a leaking condition, with broken booms and gaffs, her canvas blown away, and her men tired out, with the water in the hold gaining on them. The life-boat was at once headed for her and took off her commander, and bore away for Alpena, where the two captains engaged three tugs for the assistance of their vessels, which steamed out under cover of the land for North Point, with the life-boat in tow, having on board fresh men to relieve the men at the pumps. The sea was running so high between the point and the vessels that the tugs were unable to reach them, but the life-boat succeeded in getting alongside each vessel in succession, and in transferring the fresh men.

Both schooners were safely brought into harbor by the tugs the next morning, the sea having somewhat subsided. The captains testified that but for the assistance of the life-boat their vessels would have been lost, with perhaps all on board.

WRECK OF THE BERLIN.

The next wreck of the year within the field of action of the Life-Saving Service was that of the schooner Berlin, bound from Marblehead to Bay City, which ran upon Burnt Cabin Point Reef, Lake Huron, No-

vember 8, 1877, seven or eight miles distant from Station No. 1, District No. 9, Point aux Barques. The Berlin grounded on the reef about seven o'clock in the evening, during a heavy storm, worked in to within a mile and a half of the shore during the night, and toward morning, being an old vessel, began to break up rapidly. During the night one man perished in the rigging, and at daylight three more were swept away by the sea.

The vessel being discovered in the morning, and not being within the limits of the patrol of the station, and removed by distance and by the curvature of the coast from its observation, a telegram was sent to the keeper informing him of the disaster. As this message had to be sent by a circuitous route, it did not reach the keeper until 10 o'clock a. m. The sea was tremendous, and to avoid the delay and danger of pulling the boat broadside to it a distance of seven or eight miles, the keeper procured two pairs of horses for its transportation by land, and arrived abreast of the wreck about 3 o'clock p. m., having been delayed by an exceedingly rough and miry road.

The boat was at once launched and pulled for the wreck, only a portion of the bow of which was above water, and two men, still alive, though in a benumbed and exhausted condition, were taken from it, together with the dead body of the captain's son. Under the circumstances, assistance could not have been rendered earlier to this unfortunate vessel. The report of the officer who made the investigation in this case will be found in the appendix.

WRECK OF THE MAGELLAN.

The third wreck of the year was that of a schooner of 350 tons, the Magellan, bound from Chicago to Toronto, which was discovered at daylight in the morning of November 9, 1877, by the keeper of Life-boat Station No. 12, Tenth District, drifting, bottom up, in a northeast gale and rough sea, off Two Rivers, Lake Michigan. The captain and crew, eight in number, had all been drowned. Only one body came ashore.

WRECK OF THE HURON.

The wreck next in order of time, one which was enormous in its proportions and horrors, and may be said to have cast a gloom upon the nation, was that of the United States steamer Huron, which took place by the stranding of the vessel at about 1 o'clock a. m. on Saturday, November 24, 1877, near Nag's Head, North Carolina. The tragedy occurred during a moderate gale, but the night was dark and misty, and there was a heavy sea. As the particulars are already familiar to the public, it is only necessary to record the fact that the vessel became a total wreck, and that, according to the official report of W. P. Conway, Master, U. S. N., the senior surviving officer, received through the Navy Department, there were 132 persons on board, of whom 98 were lost. The censure at first thrown upon the Life-Saving Service, because assistance was not ren-

dered to the vessel from the adjacent life-saving station, two and a half miles distant from the wreck, was lifted when the fact became known that provision had not been made by law at that time, as it has since been, for manning and opening for service the stations in that locality at so early a date, and they were consequently closed. The calamity, therefore, occurred and was almost over before, on that desolate coast, the tidings of the disaster had spread beyond a few fishermen, and under these circumstances the Life-Saving Service must be exonerated from blame for the grievous loss of life involved, which, together with the destruction of the vessel, the proceedings of the naval court of inquiry instituted to investigate the wreck, refer wholly to errors in the navigation of the Huron. It must, however, always be regretted that the nearest life-saving station was not in operation, since in that case the early discovery of the wreck by the patrols would have been made, and, considering the contiguity of the vessel to the shore, it is probable that every person on board might have been saved.

Nothing mitigates the tragic character of this disaster except the fact that from first to last, during the entire six hours in which the Huron lay careened in the darkness, with the immense seas breaking in deafening confusion over her, the noble discipline of a man-of-war was maintained upon her decks, and officers and men alike faced the chances of life and death with composure and courage.

Of the gallant conduct of Ensign Lucien Young and the seaman Antoine Williams, who undertook the hazardous enterprise of swimming with a line to the shore in the hope of succoring their helpless comrades, due mention is made in another part of this report.

WRECK OF THE FRANK JAMESON.

Of six seamen on board the schooner Frank Jameson, five were lost by the total wreck of the vessel, which, by the breaking of her steering apparatus, while upon a voyage from Rockland, Me., to Richmond, Va., became unmanageable, and ran ashore at midnight, November 25, 1877, in a rough sea, directly opposite Station No. 8, Fifth District, coast of Virginia, where she broke up before morning, her crew, with one exception, being washed off and drowned.

The survivor came ashore in a helpless condition, but by the care and attention of the life-saving crew, who were upon the scene by nine o'clock the next morning, was restored. The disaster was rendered sadder by the fact that the entire crew might easily have been saved had the life-saving station been open, or the keeper and his men summoned in season. It took place, as the date shows, several days before the time had arrived for the opening of the station. The light-keeper at Smith's Island was aware of the stranding at midnight, but supposed the schooner was in no immediate danger, and waited until daylight before sending news to the keeper of the life-saving station, who lived at a distance. The keeper hurried to the scene as soon as possible, but by

the time he arrived the rough surf had dismembered the vessel, and her crew were lost, with the single exception mentioned.

WRECK OF THE OSSIPEE.

Another wreck which took place before the opening of the stations, was that of the brig Ossipee, bound from Denia, Spain, to New York. The vessel had her sails blown away and her mainstay parted, and in this condition drifted ashore at noon in thick and stormy weather, during an easterly gale, on November 25, 1877, at Ragged Point, Virginia, 7½ miles from Station No. 4, Fifth District. The sea being very high, the brig soon became a total wreck. A boat from the vessel succeeded in reaching the shore with a part of the crew, and in returning for the remainder was capsized and two men were drowned. Of the whole number on board, seven were saved, as, in the judgment of the keeper, all would have been had the adjacent station been open.

WRECK OF THE SEA LION AND J. G. BABCOCK.

Two wrecks which occurred simultaneously upon Cape Cod, on January 3, 1878, involved the loss of seven lives from one of the vessels. At seven o'clock in the morning, Patrolman Cole, of Station No. 11 (Orleans), Second District, reported a schooner ashore two miles north of the station, which proved to be the J. G. Babcock, bound from Hoboken to Boston. A thick snow-storm was prevailing, with a heavy northeast gale, and the sea was very rough. The station crew immediately set out for the wreck with the mortar apparatus, the condition of the sea making boat-service impracticable. Their journey was extremely toilsome. The gale was so violent that progress against it was difficult, and the sand, in addition to being very soft, was covered with snow to the depth of three inches, which clogged the wheels of the hand-cart, sometimes four inches deep, and so badly that the men were frequently obliged to pause and beat it off. One of them being absent on the south patrol, they were also one man short. When about half way the surf of the flood-tide compelled them to diverge from the beach, cross the sand hills through a hollow, and continue their way on the inside. Notwithstanding these obstacles, added to the burden they were dragging, they contrived, by laborious effort, to arrive abreast of the wreck within an hour and a half. Shortly before passing from the beach through the hollow they came upon a boat, evidently belonging to the vessel, with one oar lashed to it. Near by was the top of a chest. Although the vessel was within 300 yards of the beach nothing could be seen of her except when the squalls rent asunder for a moment the vast shroud of the snow-storm. Their first glimpse of her was obtained in this way a few minutes after they had passed the boat. When within one-third of a mile of her she was again disclosed, and they saw her masts fall. She was entirely in pieces when they came in front of her, having split in halves lengthwise and broken off at the floor-timbers. She appears to have broken up

shortly after her masts fell. The pieces which came ashore were very rotten, which accounts for the rapidity of her breaking up. The seven men who composed her crew perished. Four of their bodies came ashore within two days afterward. It should be said here that the presence of their boat upon the beach, together with the cover of the chest, creates the presumption that they attempted to effect a landing when the vessel struck and were upset by the surf and drowned.

Just before coming up to this wreck the station crew discovered another schooner ashore half a mile farther on, which turned out to be the Sea Lion, bound from Hoboken, N. J., to St. John, N. B. As the J. G. Babcock was past assistance they hurried on to the other vessel, which had stranded within 200 yards of the beach. Upon arriving abreast of her they found her boat upon the shore, but no trace of her crew. Supposing them to have perished in the attempt to reach the shore, they scattered along the beach to search for their bodies, and were engaged in this quest when news was brought that the crew were safe at the station.

It appears by the statement of the captain, that his vessel struck at 6.30, when he immediately let go his anchor to bring her head round to the sea that he might lower his boat for the shore. He was not aware that there was a life-saving station on the coast, or he would have remained with his crew on board until help arrived, as he thought upon leaving the vessel that there was little possibility of their getting on shore alive. That he and his four men succeeded in reaching the beach in a sea so dangerous, is little less than miraculous, and is only accounted for by the supposition that the position of the stranded vessel interposed a partial barrier which moderated the rush of the surf upon the beach at the point of his landing. There was not one chance in ten of the success of the venture. As it was, the boat was nearly filled with water twice before gaining the shore. Upon getting to the land, the shipwrecked men attempted to proceed up the beach, against the wind, the force of which, however, the captain says, soon baffled the effort, and compelled them to cross to the inside, behind the sand hills, and to travel in the other direction, passing, behind this screen, the life-saving crew on their way to the vessel, and arriving at the comfortable station, which, being closed on account of the absence of its occupants at the wreck, they entered by raising a window. They were all frost-bitten, and the captain had his shoulder badly bruised before leaving the vessel. Superintendent Sparrow, who arrived at the station, took him to the nearest surgeon, who dressed the bruise, and after receiving two days' succor at the station, he and his men were provided with free passes by the kindness of the officers of the Old Colony Railroad, and left for Boston, where they were to report to the British consul.

The captain stated that he observed the schooner J. G. Babcock on the bar, but saw no person on board of her. It is probable that her unfortunate crew, like the men on board his own vessel, lowered their boat

and made for the shore immediately upon striking, perishing in the endeavor, as seamen, who are little familiar with the difficult art of managing boats in the surf, are almost certain to do unless accident protects their effort.

WRECKS OF THE SCHOONERS POW-WOW, ADDIE P. AVERY, AND MILES STANDISH.

A triple wreck, occurring also upon Cape Cod, in the neighborhood of Station No. 8, Second District, and upon the same day, January 3, as that of the disaster last related, was the occasion of the unavoidable loss of twelve lives. Between four and five o'clock in the morning a patrolman roused the station with the news that a three-masted schooner, which proved to be the Addie P. Avery, of Port Jefferson, Long Island, James A. Thompson, master, was ashore upon the outer bar, half a mile north of the station. The station crew, instantly alert, was engaged in preparations for a rescue, when another patrolman hurried in with the information that a small fishing schooner, afterward known to be the Pow-wow, of Provincetown, Mass., Matthew Eaton, master, was ashore about a third of a mile to the southward of the station.

The keeper, Capt. Nelson Weston, was for a moment greatly embarrassed in regard to the course to be pursued, two vessels, with crews in peril, being simultaneously on shore in opposite directions, help being possible to only one of them at a time, as to divide the life-saving force, consisting of only seven men, would fatally weaken its efficiency, and there being no possibility of signaling for aid from the adjacent stations on account of the blinding snow-storm. The keeper solved the dilemma by resolving to first aid the Pow-wow, on the consideration of her probably having, as the event proved, the greater number of men on board, and being less likely, as the smaller vessel, to hold together in the breakers.

The condition of the surf determined the use of the mortar apparatus in preference to the boat, and as much of it as could be transported at one time through the soft sand and slush was loaded upon the hand-cart and toilsomely dragged abreast of the Pow-wow. A portion of the crew then hastened back to the station for the remainder of the apparatus, while the rest were busied in preparations for the rescue. It was then daybreak, and suddenly, through a rift in the whirling snow, another schooner was descried ashore about a mile to the southward. To this vessel, which was ascertained to be the Miles Standish, of Provincetown, the keeper hastened, leaving his crew in charge of a surfman, and as he came up to her saw her people, who were twelve in number, jumping ashore from her bows as the receding seas permitted, her commander, Capt. John B. Bangs, having, when she first struck the outer bar, crowded on all sail, forced her over, and driven her well up on the beach.

The arrival of the keeper was a fortunate circumstance for her crew, as, in the water-soaked condition of their clothing, and exposed to the icy blast, they would soon have become helpless, and, perhaps, have per-

ished, the snow-storm completely preventing them from seeing what direction to take for refuge. Guided by him upon a route behind the beach hills, where they were less exposed to the bitter gale, they reached the station, and were furnished with dry clothing and restoratives.

The keeper then hastened to the Pow-wow, where he found his comrades ready for operations with the apparatus as soon as the vessel, which had parted her sheet-cable and was dragging along the outer bar by her small anchor, should fetch up. At the first shot, the line fell across her main-topmast stay. The crew, who were hanging on in the fore-rigging and on the bowsprit, being benumbed with cold, and, besides, needing their strength to keep their hold, as the vessel was rolling heavily, made no effort to go aloft to reach it. After an ineffectual attempt to get it within their reach by working it from the shore, the keeper determined to fire again, depressing the gun so as to carry the line, if possible, among the men, which he successfully did, the line falling upon the bowsprit, where it was grasped by the people clinging there. Drawing upon it, they soon had on board the inch and a half whip-line attached thereto, but the wreck was now again drifting southward, and it was impossible to set up the hawser for the employment of the breeches-buoy or life-car, and the wreck, moreover, was beginning to break up.

In this strait, signs were made to the sailors to severally attach themselves to the line and jump overboard. By this means ten, out of the fifteen persons constituting the vessel's company, were one by one drawn ashore. This desperate measure, which necessity compelled, was rendered even more dangerous by the terrible character of the surf and by the presence in the tumultuous water of fragments of timbers, spars, and planking from the vessel, capable of inflicting the worst bruises and fatal wounds, and, worse still, of masses of tangled and writhing cordage, forming the most perilous of snares for one struggling through the breakers.

In effecting the landing of these unfortunate men through such perils and difficulties, the fiery heroism of surfmen, so often seen upon our coast, was again manifest. As the sailors were drawn severally toward the shore, station men, with cords around their waists, the ends of which were held by their fellows, would go deep into the fearful undertow to aid them. At one time the men on the bowsprit had not hauled back sufficient line to enable the next passenger to be pulled ashore, and seeing that they were about to lose their only chance for life, they secured the line on board, thus leaving the man held fast in the breakers. To save him two surfmen, at the greatest risk to themselves, rushed into the surf, and with herculean effort succeeded in taking him out of the line in which he had fastened himself, and brought him ashore. In the instance of the tenth life saved, the sailor attached to the line had got caught in the wreckage of the jib, and two of the surfmen who had gone into the breakers to clear him became entangled with him in the

snarl of floating cordage, and were in extreme danger. To rescue them another surfman, with incredible hardihood, rushed into the boiling surf with his knife and cut them free by severing the line beyond them. This daring feat, necessary for the safety of the three men, involved the sacrifice of the connection thus far maintained with the vessel. One man yet remained on board, apparently senseless, clinging to the rigging. The vessel had now drifted near the shore, and a line was thrown to him by the heaving-stick. He made no effort to grasp it, and presently fell off, lifeless, into the sea. A surfman gallantly plunged after him into the undertow, but without avail. Another man had previously dropped from the bowsprit exhausted, and had perished, and a boy had frozen to death. These three lives were all that were lost after the arrival of the life-saving crew upon the scene. It appears that when the vessel first struck, the captain and one man sprang overboard and were drowned. Five persons, therefore, in all perished. The remaining ten were saved through the strenuous efforts of the life-saving crew, as narrated, and were assisted to the station as they landed by the people from the Miles Standish. They were all frostbitten, and in some cases so much exhausted that restoratives had to be forced down their throats. Their frost-bitten limbs were treated with cold water and snow, and afterward with poultices of raw potato, and everything possible was done at the station to restore them.

During the operations for the rescue of the crew of the Pow-wow, the quantities of wreckage that came down from the Addie P. Avery, including a portion of her bow, indicated that she broke up soon after striking. There were six persons on board, all of whom were lost.

The twenty-two persons saved from the Pow-wow and Miles Standish were sheltered for a day at the station, and were all provided with clothing by the station crew, who for this purpose relinquished all their spare garments, a frequent loss to which our brave and humane life-saving crews are subjected. Free passes to their homes by railroad were also procured for these survivors.

WRECK OF THE METROPOLIS.

The marine disaster of the year upon our coast, second in importance only to that of the Huron, was the wreck of the Metropolis, a wooden steamer of 878 tons, commanded by Capt. J. H. Ankers, which sailed on the 29th of January, 1878, from Philadelphia for Brazil, laden with railroad iron and materials, and having on board a large body of laboring men. Springing a leak the day after she sailed, which steadily increased and could not be stanched, her captain, to save her from foundering at sea, ran her ashore 4½ miles south of Station No. 4, Sixth District, Currituck Beach, North Carolina, at 6.45 on the morning of the 31st, where, in the course of the day, she went to pieces. The wind was in the east at the time, the sea high, and the weather thick and foggy. The number of persons on board was 245, of whom 85 were lost. These are the

outlines of a catastrophe, the details of which are comprised in the report of investigation upon the occurrence by Capt. James H. Merryman, Inspector of Life-Saving Stations, made under the orders of the Secretary of the Treasury, hereto appended.

It will appear upon examination that the fundamental cause of the loss of life upon this occasion was the undue distances which at that time separated the stations upon the North Carolina coast.

The establishment of intermediate stations provided by the act of June 18, last, and recommended by the reports from this office for two years previously, would have located a station in the immediate vicinity of this disaster, and it is plain that the contiguity of this and of other stations thus created would have been the condition for prompt discovery of the wreck, exertions as prompt for the rescue of those on board, the immediate procurement of fresh means and appliances if demanded, the summoning of other crews to aid in the effort for deliverance, and, in one word, the trebling of the powers and resources of the life-savers. On the other hand, it is equally clear that the distance of 12 miles which existed between Stations 4 and 5 at the time of the disaster seriously impeded and baffled the intense struggle which ensued for the rescue.

In connection with this wreck, the establishment was called upon to perform one of the most painful duties that could have been devolved upon it, namely, to recommend the dismissal of the keeper of the station, a man who in many respects was worthy of honor, particularly in regard to his conduct at the disaster. The fact that his flask was not filled with the station powder upon this occasion, indicates his main defect as a keeper, a certain lack of forethought, which had previously been noted, and had indeed made his removal already determined upon. He was personally an excellent man, and he was also a skilled surfman, and, in other respects than the one mentioned, a good keeper. It cannot be denied, and it is due to him to say, that his behavior at the wreck of the Metropolis was characterized by great energy and gallantry. The news being brought him that the vessel was dropping to pieces, and that men from her were already in the surf, he hurried on ahead of his crew with the medicine-chest strapped to his back, and was the means of saving a number of lives by the prompt application of its restoratives. His conduct of operations at the wreck was in all respects satisfactory. The steamer lay nearly head on to the shore, presenting but a small mark for mortar practice; yet at the second shot he succeeded in throwing a line across the port foretop-sail yard-arm, which, if it had been judiciously hauled in, would probably have been the means of saving every life on board. Subsequently, when the last hope of renewing the broken connection with the wreck had to be abandoned, he put on the life-saving suit and made two desperate and hazardous efforts to force his way out with a line to the vessel through the tumbling fragments and the fierce current. In the struggle of the last three hours in the breakers, he was foremost and indefatigable, braving every danger, and saving many per-

sons, including the captain, whom he was the first to seize in the surf. He was repeatedly struck down in the undertow by whirling timbers and bruised and battered by the wreckage, but he stood to his work to the very last moment, constantly at the hazard of his life. It was impossible that conduct such as this could fail of its due appreciation; yet it could not be overlooked that to the circumstance of his powder-flask not being full the cessation of effort to rescue the people upon the wreck by the life-saving appliances was due, and in view of this fresh evidence of dangerous defect in an otherwise stout and manly character, the recommendation of a more careful man for keeper could not but be made.

WRECK OF A FISHING BOAT.

One life was lost from a small fishing-boat three miles out from Station No. 4, Tenth District, Lake Michigan, on March 23, 1878, before the station had been opened for service. The boat was seen from the station, capsized, with two men clinging to the bottom, by the keeper's little son Frank. The only persons at the station were the keeper (Sanford W. Morgan), his boys Frank and James, and his daughter Edith, a girl of eighteen. Not being able to launch the heavy life-boat, they attempted to go out to the rescue in a small fishing-boat, but the sea was very rough, a northerly gale prevailing, and they failed to force the boat through the breakers. A signal was then hoisted to encourage the men clinging to the capsized boat, and the boy James hastened away to a distant village for help, while the keeper, with his other boy and the girl, got everything ready for the launch of the life-boat. The boy returned with six men, who, together with the keeper, Frank, and Edith, made a crew, and the boat put out to the rescue. In this sortie, the sea rolling heavily and the wind blowing so hard that it carried the tops of the waves continually over the life-boat, and compelled almost constant bailing, the brave girl held her place at the oar. When within half a mile of the capsized boat, one of the unfortunate men was washed off by the sea and drowned. The life-boat came up in time to take off the other, so badly chilled that he was nearly gone. The keeper testifies that if there had been a crew at the station when the boat was first descried he could have saved both men.

WRECK OF THE MINNIE CORLETT.

The schooner Minnie Corlett, bound from Chicago to Pentwater, was driven ashore at two o'clock in the morning, March 24, 1878, in a northerly gale and snow-storm, the night being very dark and a heavy sea running. The point of stranding was two miles from Life-Boat Station No. 7, Tenth District, and the wreck was so sudden that there was no time for assistance. The vessel was so near land, that four men out of her crew of five jumped ashore and were saved. The fifth man was washed overboard and drowned. The vessel was a total loss.

WRECK OF A DORY.

A life was lost by the capsizing of a dory on the 16th of April, 1878, near Station No. 10, Second District. The wind was fresh from the northeast at the time, which was about eight o'clock in the morning, and the keeper of the station, Walter C. Knowles, was on the beach, with five of his men, about 80 yards north of the house, watching the movements of eight dories coming in from seaward through the breakers, when suddenly one of them, in the act of rounding to, evidently to get head to sea, was seen to capsize. The promptness with which the keeper and his men hurried to the rescue may be inferred from the fact that they rushed to the station, got the surf-boat afloat, and reached the capsized dory before one of the other seven which were coming through the breakers at the time of the accident could be relaunched for an attempt at rescue. The capsized boat was held in the breakers by her anchor, which had dropped and caught, when she was overturned. Two men had been on board of her, Daniel Sparrow and his son Wilbur, and the latter was clinging desperately to the forward part of the boat's bottom, with the surf breaking over him, when the surf-boat came up. He was rescued from his dangerous position with considerable difficulty, on account of the hazard to the surf-boat crew of approaching him in the breakers, but after much skillful and perilous manœuvering the feat was accomplished, and he was taken on board insensible. His father was then observed floating face downward, about 60 yards distant, in the inner breakers. He was reached, taken into the boat, a hurried landing was effected, and a team being fortunately at hand, the two inanimate bodies were quickly got to the station, and the usual method of resuscitation was vigorously employed. After thirty minutes, Wilbur Sparrow was restored to life, but all effort failed upon his father. It appears that the deceased had heart disease, and it is probable that he died immediately from that cause when first thrown into the sea.

WRECK OF THE JOHN CLARK.

The last wreck of the season, involving loss of life, was that of the ship John Clark, bound from Sandy Hook to Calais, Me., with a crew of 20 men. The disaster took place two and a half miles east of Station No. 2, First District, coast of Maine, at 10 o'clock p. m., May 5, 1878, four days after the closing of the station. A heavy southeast gale was prevailing, and there was a rough sea and thick fog. The ship struck upon a reef at a short distance from shore, and driving over it, went upon the rocks, where she quickly broke up, leaving the crew adrift upon pieces of wreck. Two of them were drowned, and the other 18 contrived to land about one o'clock in the morning upon a rock separated from the mainland at high water, where they staid with difficulty and in danger, the sea constantly breaking over them, until ebb tide, when they got ashore and traveled a mile and a half to Cutler Harbor. The station being closed, the keeper, who lived at a distance, knew nothing of the wreck until two days after.

RECAPITULATION.

The foregoing narrative shows that of the 226 persons lost, 108 perished in disasters occurring when the stations were not open for service; 98 from the Huron, 5 from the Frank Jameson, 2 from the Ossipee, 2 from the John Clark, and 1 from a fishing boat. Two shipwrecks occurring at remote distances from the sources of assistance produced 89 deaths; 85 from the Metropolis, where the herculean efforts of the surfmen and their neighbors nevertheless saved nearly two-thirds of those on board, and 4 from the Berlin. In two instances, vessels dropping to pieces almost immediately upon striking caused 13 deaths; 6 from the Addie P. Avery and 7 from the J. G. Babcock. In the case of the Pow-wow, 2 perished in the effort to swim ashore when the vessel first struck, and 3 from exhaustion and cold while the life-saving men were violently toiling for the deliverance of the crew. The capsizing of the Magellan in the night, and far from shore, caused 8 deaths. Of the remaining three cases of loss of life, 1, on the Lake Forest, was that of a man killed by the falling of a boom, 1, on the Minnie Corlett, of a sailor swept overboard by the sea from the rigging when the vessel struck, and 1 resulted from heart disease of the victim in the shock of being thrown from a capsized dory. In all these instances it is apparent that the loss of life was unpreventable.

DEATH OF SUPERINTENDENT GUTHRIE.

The mortuary record of the year is peculiarly darkened by yet another loss, that of a gentle and gallant man, Capt. J. J. Guthrie, the Superintendent of the Sixth Life-Saving District, who, it will be remembered, perished with four other persons on Sunday, November 25, 1877, the day following the wreck of the Huron. In his anxiety to reach the scene of the calamity, and to see that all possible succor was being extended to the survivors, Captain Guthrie left Hampton Roads with a wrecking party on board the steamer B. & J. Baker, at seven o'clock on the evening of the 24th, and arrived at the locality, after a rough run, early the next morning. The sea was still so boisterous that it was not possible to land from the steamer at that time, but having somewhat subsided by two o'clock in the afternoon, it was then determined to make the effort, and a boat was lowered from the wrecking steamer containing Captain Stoddard, Mr. Henry L. Brooke, of the Norfolk Virginian, Captain Guthrie, and a crew of five men, four of them colored, including the steersman, James Saxton, who was reputed to be one of the ablest surfmen on the coast. The boat came shoreward in good style up to the surf on the outer bar, 100 yards south of the Huron and 200 yards from shore. The first breaker, a huge mound of tumultuous water, was gallantly surmounted by the boat, which then swept swiftly down the long valley of the subsiding wave, when another tremendous breaker arose aft, and, although the crew pulled for their lives, overtook the boat, caught it under the quarter, whirled it broadside to, and flirted it,

bottom up, ten feet into the air, spilling every one on board into the sea. Captain Stoddard, Mr. Brooke, and one of the crew caught at the boat when it fell down, and although it rolled convulsively in the surf, they succeeded in clinging to it and were swept ashore. One of the negro crew, Wilson, swam with a singular facility to the land, where he arrived hardly weakened, though the struggle for life on the part of the others was as desperate as unavailing. All the remaining members of the crew, including the powerful steersman, Saxton, were quickly drowned, and swept away by the current. Captain Guthrie came up once and was instantly submerged again, his body not being recovered until the 28th, three days after this tragic accident.

In the loss of this officer the establishment has to deplore a Superintendent of marked fidelity and energy, who exercised a peculiarly sympathetic control over the crews of his district, while the community where he lived, among whose members he was loved and honored for his many accomplishments, his known bravery, and the mild sweetness of temper which marked his daily intercourse, has deeper reason to mourn his departure. For the larger part of his life he was an officer of the Navy, having had a varied experience ashore and afloat, serving in the Coast Survey and the Observatory, and on men-of-war in the Mediterranean, the Spanish Main, the East and West Indies, and the coast of Africa. Although nothing was so apparent about him as his good nature and almost feminine gentleness, he had been upon many occasions in his naval experience the dashing leader of perilous enterprises. He is reported as having always been at sea a close student, and to have possessed considerable classical attainments, and a knowledge of six or seven languages, two of which he is said to have spoken with facility. His life had been that of a sailor, and he died a sailor's death. To his closing hour belongs the noble and consoling thought that he faced his last peril with an unquailing soul in the interest of fellow-beings, and perished in the strict line of duty.

EXAMINATION OF KEEPERS AND CREWS.

A board of examiners, consisting of two Revenue Marine officers and a medical officer of the Marine Hospital Service, annually visit the stations soon after the beginning of the active season for the purpose of examining professionally and physically the keepers and surfmen. One of the Revenue Marine officers is an assistant inspector of the service, who, in addition to his share of this duty, also thoroughly inspects the stations, and, with the keeper of each, composes a board of survey upon the unserviceable station property, relative to the disposal of which they make recommendation. The medical officer also instructs and practically exercises the men in the method of resuscitating the apparently drowned adopted by the service. The board thoroughly drill the crews in all professional operations and give them instruction in regard to any new appliances and methods introduced.

The results of the examinations of last year were generally gratifying.

Marked improvement in the *personnel*, resulting largely from the action of former boards, and improved discipline and increased proficiency in the use of the various apparatus, the consequence of drill and instruction, were manifest.

The change which had taken place in the districts specially alluded to in the report of 1877 as having been seriously affected by the influence of local politics was surprising, and the radical cure of the evils which affected them, attests the virtue of the summary treatment applied.

The following is a brief synopsis of the reports of the boards of examiners with reference to the several districts, and shows their relative condition as compared with that of the preceding year:

In District No. 1 the number of keepers examined was 6, and surfmen 36, all of whom were found to be competent and efficient men. The board reported the condition of the district excellent, and generally improved in all respects. With reference to the only station in this district of which the board of the preceding year found it necessary to speak disparagingly, as requiring a stricter attention to cleanliness, the report of the last board says: "We were gratified to find the house in fine order and the crew fully up to the mark."

The Second District was found generally in a satisfactory condition. It is painful, however, to be obliged to record a grave instance of delinquency which was discovered on the part of a crew whose record had hitherto been excellent. The board arrived at the station referred to on Thanksgiving Day, about dark, and found the station locked and the crew absent. Inquiry proved that they were at one of those social gatherings with which New England villages are accustomed to celebrate their chief annual holiday. It is true the wind was blowing off-shore, and shipwreck was unlikely to happen, and the temptation was undoubtedly extreme to participate in festivities to which in that part of the country friends long separated and the companions of early years assemble alike from immediate neighborhoods and the most remote sections. Nevertheless, failure to maintain the patrol being always in this service, like unfaithfulness in the guard of the soldier, unpardonable, this brave crew was summarily dismissed, the necessity being also imperative to impress all other crews by this example that the duty of maintaining vigilant and unremitting watch upon the coast is paramount and absolute.

The station which in the preceding year was in an unsatisfactory state, and from which the delinquent keeper was removed, was now found by the board in excellent order. The men examined in this district were 13 keepers and 78 surfmen, none of whom were unqualified.

In District No. 3 the number of keepers examined was 35, and surfmen 200. Four of these keepers were found to have arrived at such an age as, in the judgment of the board, impaired their energy and physical activity, and, upon the suggestion of the examiners, they were allowed

to tender their resignations. These faithful men had been years in the stations, and their official life presentéd a record without blemish. Their labors had been patient, arduous, and perilous through the struggling years of the growth of the establishment, and had been rendered at a rate of pay despicably small, and it seemed cruel to cast them out in the hour when the noble work of themselves and their associates was about to result in the fuller development of the service, involving the better compensation of its crews. The necessities of the service, however, left no other course possible.

Three keepers were recommended for removal, on account of neglect of duty and incompetency, and one for absence from his station upon a foul night. Of the 200 surfmen examined, 4 only were found incompetent, but 6 others, the crew of the station under the charge of the keeper last mentioned, were dismissed for neglecting patrol duty on the night of the keeper's absence. The district was represented as improved, particularly in respect to the faults observed the previous year. Representatives of two of the prominent daily journals of New York City having applied for permission to accompany the board on their tour through the district, were cheerfully allowed to do so. A series of interesting accounts of the methods of examination and drill, with the impressions of the writers regarding the conduct and value of the service, was published in the respective journals to which they belonged.

In District No. 4 there were 38 stations, at which crews were maintained during the last winter; and 38 keepers and 228 surfmen were accordingly examined. Three of the former were recommended for removal as incompetent, and 10 of the latter were dismissed, nine for incompetency and one as physically disqualified. This important district is a highly efficient one. The board remark that "the drills showed on the part of the several crews a thorough knowledge of the use and application of the various apparatus, almost without exception."

Tne crews of the stations in District No. 5 numbered last year 8 keepers and 48 surfmen. These, together with three surfmen, presented to take the places of that number rejected, were all thoroughly examined. None were found professionally disqualified, but one keeper was recommended to be removed on account of physical disability and lack of administrative capacity, the latter disqualification being particularly evidenced by his failure to properly govern his crew. The three surfmen dismissed belonged to his station and were removed for insubordination. This is the district which the board of the previous year reported to be in so unsatisfactory a state at the time of their visit as to require radical reformation, involving many changes in the keepers and crews. A full and candid presentation of the unorganized, almost chaotic state of affairs which prevailed for a brief period, and of the causes which produced it, together with a statement of the prompt remedial measures adopted, were given on pp. 33, 34, and 35 of the last annual report of the service. That these measures were highly successful is evident from

the expressed gratification of the board at the efficiency of the crews in handling the apparatus, due to almost constant practice; from their declaration, in contrasting the condition of the district as they found it with its former state, that it would now compare favorably in this and some other respects with any of the older districts; and from the creditable record of the winter's work, which shows that in 16 disasters to vessels between the opening and closing of the stations, 132 persons being on board, not a life was lost.

The past year's history of this district repeats that of the Sixth District for the year previous, and fully establishes the great value of the examining boards, and the fact that the system possesses within itself the means of promptly discovering and expelling unworthy agents.

Of the 10 keepers and 61 surfmen examined by the board in the Sixth District, they regarded two of the former as not suitable for their positions and removed one of the latter. One of the keepers referred to, though adjudged to have excellent qualifications in every other respect, was not deemed to have had sufficient experience in the surf to hold the leadership of a crew of surfmen; while the other, possessing that qualification, lacked the administrative capacity of his colleague. The surfman was dismissed as incompetent.

The board spoke generally in approval of the keepers and crews of this district, representing them to be as proficient in their duties and as qualified for their work as could be expected from the brief period of their experience.

The nature of the service in the Seventh District requires no special professional qualification, the employés being only keepers of houses of refuge. No examination was therefore made in this district, the usual inspections being deemed sufficient to secure a proper administration.

In the Lake Districts (Nos. 8, 9, and 10) a large proportion of the stations are life-boat stations, where the dependence for service on occasions of shipwreck is upon volunteer crews summoned from the thickly settled neighborhoods, and not upon surfmen regularly employed and dwelling at the stations during the inclement season of the year, as is the case upon the seaboard.

For the reason that under the law as it then existed, no compensation could be made to the volunteer crews for the labor involved in examination and drill, and for the time which would have to be taken from their daily occupations, involving the loss of wages, which they were too poor to incur, the examination was necessarily confined to the keepers of those stations and to the regularly employed crews of the complete stations. Of the 21 keepers examined 5 were deemed unsuitable persons for their trust. Two of these indifferently conducted the affairs of their stations, one was found deficient in professional qualifications, and one was physically disqualified, besides lacking the ability to maintain discipline, and one was reported as of intemperate habits. This latter keeper was selected for his position on account of the great skill

and courage he had displayed upon several instances in saving life from shipwreck. His successful daring upon these occasions had won him the gratitude and praise of the whole region, which had been expressed in resolutions by commercial and maritime associations and city governments, and presentations of medals and other tokens of honor. He possesses also a medal of the first class awarded him by the Government of the United States. In skill and fertility of resource at scenes of disaster he is not excelled, and at such times, previous to the establishment of the life-boat station of which he is in command, he was looked to for leadership in attempts at rescue. In view of these facts and of his solemn pledge of reformation, he has been permitted to retain his post.

At the life-saving stations provided with regular crews, 56 surfmen were examined, all of whom, with a single exception, a case of physical disqualification, were found competent.

ESTABLISHMENT OF STATIONS.

It was mentioned in the last annual report that three life-boat stations in District No. 11 (Pacific coast), located respectively at Shoalwater Bay, Cape Disappointment, and Neah Bay, had been recently erected, and that at the date of the report they were receiving their equipments and would soon be ready for service. It was also stated that the life-boat station located at Golden Gate Park, near San Francisco, was nearly completed. The first-named station was opened November 26, 1877; that at Cape Disappointment February 15, 1878; but those at Golden Gate Park and Neah Bay, although the former was ready for service January 25, 1878, and the latter October 27, 1877, were not opened until August 13, 1878, and September 5, 1878, respectively, it having been found impossible to secure suitable persons for keepers at the rate of compensation allowed by law previous to the passage of the act of June 18, last.

After repeated effort, reasonable proposals for the construction of the life-boat stations at Cape Arago and Humboldt Bay, authorized by the act of June 20, 1874, were obtained last spring, and the buildings have been completed and are receiving their equipments. The hope expressed of obtaining title to the site selected for the station to be established at Point Concepçion has not yet been realized, but efforts to that end are still continued.

The act of June 18, 1878, having authorized the transfer of the location of the station proposed for Point Reyes to Bolinas Bay, in accordance with recommendations heretofore made, measures have been taken to secure the site selected some time since, in anticipation of such authority. It was then offered to the government at a reasonable price, for which it is probable it can now be secured. The site is an admirable one, and if obtained, as expected, the erection of the building will be commenced the coming spring.

The act of June 18, 1878, also authorized the establishment of additional life-saving and life-boat stations at or near the following-named points upon the sea and lake coasts:

One life-saving station at Cranberry Isles, Maine; one life-saving station at or near Scituate, Massachusetts; one life-saving station at or near Watch Hill, Rhode Island; one life-saving station on the coast of Delaware between Cape Henlopen and Indian River; two life-saving stations on the coast of Maryland, one of them between Indian River and Green Run, and one between Green Run and Chincoteague; fifteen life-saving stations on the coasts of Virginia and North Carolina, ten of them at intermediate points between the existing stations, three between the southernmost existing station and Hatteras Inlet, one at or near Cape Lookout, and one at or near Cape Fear Point; five life-saving stations on the coast of Texas, one of them at or near Sabine Pass, one on Galveston Island, near the west end, one at or near Pass Cavallo, one at or near Aranzas Pass, and one at Brazos Santiago, and one life-boat station on Galveston Island, near the east end; two life-saving stations on the coast of Lake Michigan, one of them at or near Sleeping Bear Point, and one at or near Bayley's Harbor, and four life-boat stations, one of them at or near Manistee, one at Ludington, one at or near Muskegon, and one at Kenosha; one life-boat station on the coast of Lake Superior, at or near the mouth of Portage Lake and Lake Superior Ship Canal; two life-saving stations on the coast of Lake Huron, one of them at or near Port Austin and one on Middle Island, and a life-boat station at or near Sand Beach Harbor of Refuge; a total of 30 life-saving stations and 7 life-boat stations.

Immediately after the appropriation for the establishment of these stations became available, steps were taken for the commencement of the work, with the view of completing and putting into operation the coming winter as many of them as was possible. The extremely dangerous character of the coast between Capes Henry and Hatteras, and the limited protection afforded by the existing stations, seemed to demand the first attention, and every possible effort has been made to hasten the construction and equipment of the stations authorized for that coast. The establishment of life-saving stations is a work that requires time. It involves the selection of sites with reference to the peculiarities of the several beaches, the obtaining of titles thereto, the preparation of plans and specifications for the buildings adapted to the different locations, the advertising for proposals, the making of contracts, the erection of the buildings, the determination of the class of the boats and apparatus which the several localities require, the manufacture of these equipments, their transportation and distribution, and, finally, the selection of keepers and crews.

By diligent effort the preliminary steps were accomplished, and two contracts for the construction of 13 stations between Cape Henry and Hatteras Inlet were secured on the 13th and 15th of August, respect-

ively; the advertisement inviting proposals having, with a view of making the timely completion of all the stations more certain, divided the number into two lots, and provided that contract for but one lot should be awarded to a single bidder. Each contractor stipulated to complete his work by the 15th of November; but bad weather, and particularly the great hurricane of the 22d and 23d of October, which swept away a portion of the materials, have much retarded the construction. Some of the stations have, however, been finished, and all of them will soon be in operation.

The existing stations in the Fifth District being long distances apart, and the coast an exposed and dangerous one, it seemed important that the building of the stations authorized for the coast of Delaware and Maryland should also be secured, if possible, before the setting in of winter. The sites for these were therefore early selected; and, fortunately, titles were secured with little difficulty, and a contract for the construction of the buildings, to be completed on the 25th of November, was made. The great hurricane referred to was more destructive in this district than upon any other portion of the coast, and the contractors lost considerable material, by which the completion of the buildings has been delayed. The stations will, however, be finished and occupied early in December.

In the mean time the points designated for the establishment of stations upon the New England coast and upon the lakes have been examined, and sites have been selected for stations at Cranberry Isles, Maine; Scituate, Mass.; Watch Hill, R. I., on the sea-coast; at Port Austin and Sand Beach Harbor of Refuge on Lake Huron, and at Bayley's Harbor, Manistee, Ludington, Muskegon, and Kenosha, on Lake Michigan; and titles have been secured to all these sites, except at Scituate—not in time, however, to admit of the construction of any of the stations the present season. Plans and specifications are in course of preparation, and the work will be undertaken as early in the spring as practicable.

Measures toward the establishment of the stations authorized for the Gulf coast have been delayed by the prevalence of yellow fever at the South, but the work will soon be commenced.

REBUILDING, REMOVAL, AND REPAIR OF STATIONS, &C.

It was mentioned in the last annual report that most of the old stations on the coasts of Long Island and New Jersey having been built many years ago to serve the purpose simply of boat-houses, and subsequently made habitable for the crews by patch-work and temporary repairs from year to year, were no longer in a condition to answer the demands of the service, without being, in some cases, rebuilt, and in others receiving quite extensive additions and renovations. A careful examination of all the stations on both of these coasts was made by competent persons, with instructions to prepare plans and specifications for such work as was absolutely indispensable to render them comfortably tenantable

for several years. Five of the stations on the Long Island coast were found to be beyond substantial repair, while 26 were reported as capable of being made useful for some time to come at an inconsiderable outlay. Two of the stations which it was determined to rebuild, located at Bridgehampton and Southampton, were mentioned as, at the date of the report, approaching completion. These were ready for the reception of their crews on the 8th and 19th of December, 1877, respectively; and during the summer a new and commodious station has been erected at Coney Island, in place of the old boat-house which stood there, and is now occupied by a crew. This station was given ampler dimensions than any other in the service, being designed for an experimental station as well as for the habitation of a crew, on account of its favorable location for conducting experiments with life-saving appliances and for testing the value of devices which may be presented for trial.

About midway between Fire Island and Coney Island upon this coast is a place known as Short Beach. It is an uninhabitable stretch of sand three miles in length, and especially dangerous by reason of the bars which make out from it a long distance seaward; and being cut off from the supervision of the patrol of Station No. 27 by Zack's Inlet on the east, and of No. 28 by Jones' Inlet on the west, the possibility of the seasonable discovery of a wreck, from either direction at night or in thick weather, is thus precluded. The citizens of the town of Hempstead, to whom this island belonged, appreciating the need for the establishment of a life-saving station thereon, donated a site to the government, upon condition that one should be put upon it. The station is now in process of construction, and will soon be occupied by a crew.

The new stations mentioned as desirable to be built at Amagansett and Montauk Point have not been erected, it being thought that the old station at the former place might answer for another year, and it being found impossible to obtain title to the site selected at the latter place on account of the premises being in litigation.

On the coast of New Jersey it was found necessary to rebuild but two of the stations, repairs only being required to make the others comfortable. Those to be rebuilt were at Long Branch and Wreck Pond, the former in place of the old Station No. 5, which was discontinued two years ago on account of the inability of the government to retain possession of the land upon which it stood, and the latter being necessary to take the place of the old Station No. 8. The buildings are rapidly approaching completion, and will be opened some time next month.

All the requisite repairs upon both coasts have been completed, those to the 26 stations on Long Island at an average cost of $147 each, and to the 36 stations in New Jersey at an average cost of $133.26.

The experience of nearly two years demonstrated the impossibility of securing a suitable volunteer crew for the life-boat station at Chicago,

although, on account of the vast commerce of that port, there is no point on the great lakes where this protection to life and marine property is so much needed. It was hoped that the additional inducements offered by the act of June 18, last, for the enrollment of such crews would overcome the difficulty, and immediately after its passage an earnest effort was made to secure a corps of volunteers which could be relied upon to acquire proficiency in the use of life-saving appliances by regular attendance at the prescribed drill and exercise, and to be within ready summons in case of disaster. It was found impossible to accomplish this, however, and no recourse but the employment of a regular crew of surfmen, who should reside continually at the station during the season of navigation, remained. This involved such an addition to the building as would accommodate the crew, which has been made, and an able corps of surfmen has been secured and placed on duty at this important locality.

One of the most annoying difficulties which beset the establishment, particularly upon the seaboard, arises from the disposition of the sea to encroach inland for a series of years, at certain points on the extended lines of sandy beaches between Cape Cod and Cape Hatteras, while at other points it correspondingly recedes and permits the advancement of the beach seaward. This habit of the ocean is familiar to the dwellers of the coast, and particularly to the experienced surfmen, and their advice and assistance are invaluable in the determination of sites for the location of stations. The foresight of these men, acquired by long observation, generally enables such selections to be made as will be secure from these inroads for several years, and usually gives sufficient admonition of the approach of danger to existing stations to admit of their timely removal. A greater or less number of removals, especially upon the Long Island and New Jersey coasts, where a large portion of the stations were located several years ago, has annually to be made. During the past year there were four such instances upon the sea-coast. The stations were No. 18, at Smith's Point, and No. 26, at Jones' Beach, in the Third District; No. 3, at Seabright, in the Fourth District; and No. 6, at Hog Island, in the Fifth District. The dangers which threatened the stations at Smith's Point and Seabright were foreseen, as is usual, in season to be provided against, and they were moved to new and safe sites. But it sometimes happens that these ordinarily gradual changes of the coast line are suddenly accelerated by violent storms, and large tracts of land are abruptly carried away, and high beach hills reduced almost to a level with the sea. Experience can afford no seasonable prevision of these abrupt ravages of the hurricane, from which, consequently, the stations cannot be protected. As points from which to effectively conduct the operations of the service, the stations must necessarily be near the surf shore, and so imperative is this condition that they often have to be advanced upon the accretions which form. In one of these tempests in the late autumn of 1877, soon after the opening of the active

season, the station at Jones' Beach, and its occupants, barely escaped destruction. As soon as the storm began its havoc the keeper perceived the danger and immediately took the only course possible. He hurriedly removed the boats and apparatus to a place of safety, and with an old sail and his oars, having built a hut in a neighboring beach hill, by burrowing under its lee, he abandoned the house and quartered his crew in the improvised station. The house was soon after torn from its foundation and tumbled into the surf. With great exertion the keeper and crew succeeded in anchoring it with a line taken through the upper windows and thus prevented its being carried away altogether. The storm having abated, the many tons of sand which had been driven into the house were shoveled out and the building was, as soon as possible, re-established upon a new site. In doing this, great care was taken to render the underpinning strong and secure. The re-erection of the station and necessary repairs had just been completed, and the building reoccupied by the crew, when another and more violent tempest and surf came on. The property had not all been returned into the house, and so suddenly did the sea gather proportions, that the crew, who were at dinner, had barely time to save such of the equipments as were there, and abandon the station, before it was lifted bodily from its foundation and borne half a mile away. The foundation itself, which consisted of heavy cedar posts, eight feet in length, braced and bolted together in the most thorough manner, and buried in the ground, was wrenched up and landed by the sea at least a mile distant from its place, and singularly enough to almost the very spot which was afterwards found, in view of the changed outline of the coast, to be the most desirable site for the relocation of the station. Another singular incident is the fact that the station itself, in being borne so great a distance by the tempest and surge, had remained erect; probably owing to the load of several tons of coal upon its floor. But the most fortunate circumstance was the occurrence of both disasters by day. Had they happened at night they must have involved, not only the destruction of the station and its contents, but of a crew of brave and faithful men.

The surfmen's observations of the action of the sea in the vicinity of Station No. 6 (Hog Island), Fifth District, in the spring and summer of 1878, made it evident that the station was menaced by its approach, and accordingly in July the building was retired to a site some 1,280 yards distant, which would have secured it for several years against the ordinary progress of encroachment. The memorable tempest of the 22d and 23d of October last, however, came near causing its utter demolition. During the fore part of the night a heavy rain and wind had prevailed, which, about midnight, became a violent storm. The first two watches of the patrol had been faithfully kept, and the patrolmen of the third watch, which began at 2 a. m., had started out on their march, when the storm suddenly burst into all the fury of the hurricane. The men were unable to proceed, and were

forced back to the station for safety. They had been gone but a quarter of an hour, yet they found the floor flooded with water. They alarmed the sleeping crew, and the inspector of the district, whose duty had brought him there on the preceding day. Preparing themselves as quickly as they could, they descended to the boat room, where they were amazed to find the water three feet deep and rapidly rising. Under the direction of the inspector the lighter articles of equipment were gathered up quickly and stored in the upper rooms, and the heavier apparatus secured as well as possible in the boat-room below. The medicine-chest and records of the station were placed in the surf-boat. In the mean time the house had been lifted from it foundation, the earth around it was being washed away, and the building was settling. The floor was bulged up by the power of the sea, and the walls vibrated and groaned as the surf and tempest beat against them. The joints of the building, as it rocked backward and forward, opened and closed with menacing creakings. The destruction of the station was imminent, and it was evident that no time was to be lost. The men floated the surf-boat, which was upon its carriage, by dismounting the latter from its wheels. The keeper was endeavoring to loosen the fastenings of the boat-room doors, when they were burst in by the sea, in whose overwhelming flood the inmates were nearly engulfed. They succeeded, however, in clambering into the boat, and passed out. So completely had the water filled the building that the height it had attained at this moment barely permitted the boat to clear the high lintel of the door. Beaconed through the darkness by the light-house about a mile away they fled to its shelter through the torrents of rain, driven before the gale. In a few minutes they were safe in the light-house.

At six o'clock in the morning the wind changed, and began to moderate, and at eight the sea had subsided sufficiently to permit the crew to return to the station, which they found had been ripped from its sills and borne some distance inland. The sides and floors of the house were sprung, and the building badly racked, partially disjointed, and out of shape. Fortunately the apparatus and equipments, with trifling exceptions, were safe, though somewhat damaged by the flood. Immediate steps were taken for the restoration of the customary routine of duty. The day was spent in drying and putting in order the apparatus. That night the men kept their lookout from the light-house. The next day it was found that the building had careened and settled considerably in the quicksand. Every high tide swept around it, and threatened again to wash it away. The crew anchored it by weighting the floors, and by passing a hawser twice around the building and setting it up to the sand-anchor. When night came on again the beach could not be patrolled; all that the men could do was to maintain the watch at the station. It was not until the third night that it was found possible to re-establish the patrol, the storm had so cut up the beach into gullies and quicksands. Such temporary repairs were forthwith made as to render the station

safe and comfortable for the season, except in the event of a similar tempest. The superintendent of the district reports that nothing more can be done until the late spring, as owing to the nature of the soil of the island it will be impossible to properly set piles for a permanent foundation.

Cobb's Island, upon which Station No. 7 in this district is located, was entirely submerged, and the station there was carried about 17 feet from its position. Stations Nos. 4, 5, and 8 were also somewhat damaged in the storm by the washing of the sand from beneath their foundations.

Along the entire coast of this district, south of Station No. 2, the beaches were badly washed away and cut through with small inlets, seriously interfering with the patrols. Indeed, at some of the stations the extent of the beat has been greatly limited. The beach upon which Station No. 8 stands has suffered such a change that during full tide the patrol cannot be extended over a mile in either direction.

The damage to the life-saving stations in this district, however, is of trifling consequence compared with the great devastation of private property which marked the track of the storm. Houses were unroofed, barns and outbuildings overset and demolished, trees uprooted, and whole herds of animals drowned. It is stated that all of the famous Chincoteague ponies were swept from the island, though some of the tough little fellows succeeded in reaching the mainland, thus preserving the breed from extinction.

In the same storm damage was done to some of the stations in the Fourth District. In one instance (at Station No. 36, near Hereford Inlet) the sea burst through the windows, flooding the house and compelling the crew, as at Hog Island, to take to the surf-boat and seek the refuge of the light-house near by. The noble achievement of the life-saving men of this station at a wreck which occurred in this storm is recounted in another place.

The extraordinary fury of this tempest, and the hardships and dangers to which the men on patrol are sometimes subjected, are illustrated by the fact that one of the crew out on this duty in the Sixth District was blown off his feet by the wind and tossed over a sand-bank several feet high, his lantern being whiffled out of his hand and carried entirely away. Another of the patrolmen was pitched over three times, and finally had to crawl off and seek shelter behind the sand-hills. In the Fifth District, a patrolman not returning to the station in the morning, the shore was vainly swept with the glass by his comrades from the station lookout to discover him. Putting out along the flooded beach in the surf-boat, they finally found him lying prone upon a sand hill, a mile and a half distant, nearly dead, completely surrounded with water, in which position he had lain for several hours, clinging to the ground, his safety being only due to the eminence which had escaped submersion, and which he had fortunately gained. Such was the violence of the gale and sea upon that memorable night, that in one instance a schooner

in Chesapeake Bay was carried sheer up into the woods from her anchorage.

For the proper protection of the four Richardson self-righting and self-bailing life-boats mentioned in the last report as having been constructed for such localities upon the coasts of Massachusetts, Long Island, and New Jersey as would admit of their use, suitable boat-houses have been erected—one at Orleans, Mass., near Station No. 11; one at Fire Island Inlet, Long Island, near Station No. 23; one at Absecom Inlet, New Jersey, near Station No. 27; and one at Townsend's Inlet, New Jersey, near Station No. 34.

It has been found necessary to change the location of two of the life-boat stations on Lake Ontario, and one on Lake Erie, namely, those at Oswego, Charlotte, and Fairport. The station at the former place was originally located on the property of the government, near the shore end of the breakwater which is being constructed there for the purpose of extending the harborage of the port, the old harbor affording but meager accommodations to the shipping. This site, though an excellent one in other respects, was more remote from the usual resorts of boatmen and seafarers than was desirable for a station that was to be operated by a volunteer crew; but at the time it had of necessity to be taken, every effort to procure one upon the thickly occupied border of the inner harbor having proved unavailing. It was hoped that, notwithstanding the unfavorable location of the station in the respect referred to, a crew might be collected on occasions of disaster without serious delay; but such occasions developed the fact that the loss of time was so great as to hazard the chances of success, and compelled renewed effort to procure a place upon the inner harbor. Fortunately, after several vain attempts to secure different sites that were deemed desirable, a good one was obtained without cost, and the station has been placed upon it.

The station at Charlotte was placed, in the first instance, in an excellent location, on government property, the only drawback being a railway track running between it and the water, which, it was understood, would be removed. This not having been done, the use of the life-boat and apparatus was greatly hindered by long trains of freight-cars, which were left standing upon the track much of the time, both by day and night, obstructing the passage to the launching place. The removal of the station was, therefore, necessary. It was found that by building up the dock, which had fallen into decay, sufficient space would be provided between the track and the water upon which the building could be placed. This and the removal were accomplished at small expense.

The station at Fairport was also originally located upon government property, with the view of saving the cost of the purchase of a site. The only objection anticipated to the place selected was the difficulty of getting the heavy self-righting and self-bailing life-boat into the water when necessary; but being upon the side of the river upon which the town is situated, it was expected that this difficulty would be met by

securing sufficient volunteer aid to launch the boat directly off the beach, from the ways of its wagon, and by the use of movable skids, as is done in other countries; or, if it were necessary, to transport the boat to the dock and launch it into the river. But the volunteer assistance was not forthcoming for the necessary practice and drill to enable this method to be adopted, and the station had to be moved across the river to a place from which the boat could be launched directly from the building into the river by mechanical means, a donation of the use of the site having been made for the purpose. The only objection to the present location is its separation by the river from the town whence the volunteer crew has to be drawn. This objection, however, is of much less consequence than that which existed against the original site.

IMPROVEMENT IN LIFE-SAVING APPLIANCES.

The importance of keeping the life-saving stations supplied with the best apparatus known, so far as the means available would permit, and of constantly laboring to improve it, has always been kept in view, and during the past year there has been no relaxation of effort in either direction.

The means generally employed, and the chief reliance, as is well known, for the rescue of shipwrecked seafarers from stranded vessels, are boats of peculiar construction, commonly called life-boats, calculated, in the hands of skilled men, to successfully encounter the surf and to pass over the heavy seas beyond. The different varieties of these, and the peculiarities and uses of each, were discussed at some length in the last annual report of the service, and the nature and extent of such improvements as the researches and efforts of the establishment in recent years have been able to make in them were described. The subject has continued to receive the attention which its importance should always command, but, beyond those heretofore published, no definite results have been attained, although a considerable improvement is promised from certain measures now in progress.

While the two classes of boats now in use in the service, termed, for the sake of distinction, the surf-boat and life-boat, are capable of marvelous work, as every season attests, no boat or other floating vehicle has yet been invented which has the power to cope with every condition of surf and sea. On occasions, and they are not infrequent, when these means are inadequate, various other methods of rescue are resorted to, and none oftener than the establishment of transit between the wreck and shore with the breeches-buoy or the life-car, the first step in effecting which is the casting of a line over the vessel, generally by means of a projectile fired from ordnance devised for the purpose.

Since 1871, when a vigorous effort was begun to augment and develop the means for saving the shipwrecked from stranded vessels upon our coasts by operations from the shore, it has been the aim to have the stations, as far as practicable, supplied with the best of this ordnance,

and its accessories. Although the range which was attained with the shot-line by the mortars in use at the stations previous to late improvements was somewhat greater than that of the ordnance used by the life-saving institutions of other countries, as the features of the coasts where the latter operate generally require less for the contingencies of shipwreck, the occurrence of some sad disasters—notably the wrecks of the Giovanni and Circassian—by the stranding of vessels barely beyond the reach of our shots, have demonstrated the great necessity of extending it.

Since the circumstances of the wreck of the Giovanni summoned attention to this necessity, continuous effort has been made in this direction. The difficulties to be overcome and the measures which were adopted successively, each happily accompanied by some degree of improvement, have been related in former reports. The latest and most successful efforts have been those of Lieut. D. A. Lyle, of the Ordnance Department, United States Army, who, at the request of Capt. J. H. Merryman, Inspector of Life-Saving Stations, concurred in by the Ordnance Board, was kindly detailed to this duty by the Chief of Ordnance in June, 1877. The Ordnance Bureau had, in April, 1875, by the order of the Secretary of War, in response to an application of the Secretary of the Treasury, made at the instance of this Office, for the assistance of experts in ordnance, been joined with Captain Merryman in the prosecution of experiments with a view to the attainment of the desired improvement.

After prosecuting their researches to a considerable extent, they found that the magnitude and nature of the work they had undertaken required more time than their other important and pressing official duties allowed, and hence the application for the assignment of an expert officer to their aid, the greater part of whose attention could be devoted to the subject.

Lieutenant Lyle's report of the results of his labors, made to the Chief of Ordnance, was transmitted by the latter to this office on the 8th instant.

The problem to be solved was not only the attainment of the desired increase of range, but this with ordnance and equipments of the least possible weight and best adaptation to the exigencies of practical application. In conducting his experiments with a view to the solution of this problem, Lieutenant Lyle was charged incidentally with the determination of the kind of powder, and the charges to be used under different conditions; the size, material, and texture of the best shot-line; the best form and size of faking-box; and the proper relative positions for the faking-box and gun in firing.

His labors have been signally successful. The greatest range of the shot-line ever before attained, so far as known, is 631 yards. This was with a mortar or gun, weighing, with its bed, 535 pounds, the shot, in addition, weighing 33 pounds, making a total weight of gun and projectile of 568 pounds. This weight is too great for transportation with the other necessary apparatus from a station to a wreck occurring at a

distance, by the few men composing a life-saving crew. There are but two of these guns in the service, one being placed between two stations at a specially dangerous point, the other at one of these stations.

In the course of former experiments in the service, another gun had been developed, weighing, with its bed, 288 pounds, with a projectile of 22 pounds, making in all 310 pounds, which has given an experimental range of 473 yards. Twenty-five of these guns are in the service. The maximum range obtained by experiment with the mortar in general use in the service, which weighs, with its bed, 288 pounds, and carries a shot weighing 24 pounds—total, 312 pounds—is 421 yards.

Lieutenant Lyle has devised a gun and shot, the entire weight of which is 202 pounds (mortar and bed weighing 185, and the shot 17 pounds), which has attained a maximum range of 695 yards.

It will be seen that the gain in range, over the first-mentioned gun, is 64 yards, with a reduced weight of ordnance of 366 pounds; over the second gun, 222 yards, with a reduced weight of ordnance of 108 pounds; and over the mortar in general use, 274 yards, with a reduced weight of ordnance of 110 pounds.

The diminished weight of this gun alone makes it imperative to supply the stations with it as rapidly as practicable, except those in localities where a smaller gun devised by the same officer will secure the range required. The latter gun, with its carriage, weighs but 89 pounds, and the projectile 13 pounds, making a total weight of 102 pounds, and has thrown a line 477 yards.

It should be borne in mind, in relation to the matter of range, that the figures given above express the extreme limit which has been reached in the course of all the experiments, and that they cannot be repeated at will. These figures indicate, however, the general ratio of increase of range secured. The gain is undoubtedly sufficient to insure line connection with stranded vessels under all circumstances, at as great a distance as will admit of the successful use of the breeches-buoy or life-car, except in hurricanes or gales of so great violence as to prohibit the employment of such means altogether, for it must not be forgotten that tempests do sometimes occur in which men cannot even stand up, much less control their action to the extent of conducting operations at wrecks, a work which at all times involves difficult and laborious exertions.

The greatest distance over which the breeches-buoy or life-car can be successfully used in case of shipwreck depends upon the force of the current, the violence of the storm, and other contingencies, and cannot, therefore, be definitely determined, but it is probably less than 400 yards. It can be easily conceived, however, how a line extended from the shore to a wreck at a greater distance might be utilized in various other ways, if not so effectively as with these appliances.

In his experiments Lieutenant Lyle tested various kinds of powder, and fixed upon one as best adapted for use in the service, and also de-

termined the charges to be used under different conditions. He also experimented with, and subjected to various tests, a variety of shot-lines of different materials and texture, resulting in the approval of the braided linen line, which had already been introduced into the service as the result of earlier experiments.

For the faking of shot-lines he also approved the general form and construction of the box in use by the establishment, which is the same as is used in other countries, but has added several valuable improvements. He has, moreover, devised some important appendages to the apparatus. One of them is a convenient gunner's haversack, arranged to contain the cartridges, friction-primers and lanyards, priming-wires, combination level, &c.; and another, a light reel, to be worn by one of the crew, to facilitate the taking up of the lines after firing at practice, by which they are also preserved from being cut or chafed in dragging through the sand and over rocks.

Full and specific instructions in the manner of using all the appliances employed in connection with ordnance in effecting rescues are embraced in his report, which also contains a minute description of every article, a complete statement of the process of its manufacture, the materials employed, their weights and measurements, and the methods of testing them, and a faithful record of every step and feature of his experiments. This office having furnished him with the results of all the former experiments of the service, together with such information in relation to the subject as it had collected from foreign sources, these, and considerable more which his own investigations have discovered, are also presented.

The results of his examination of certain inventions designed as improvements in this variety of life-saving apparatus which have been brought to the attention of the service, and referred to him for consideration, are also given.

The entire report is a work of such great general interest, and contains so much important information and instruction which ought to be in the hands of every person connected with the establishment, that it is published herewith. Besides being a comprehensive record of all that he has done in the prosecution of his labors, it is an exhaustive and invaluable compendium of the history of whatever has been achieved in this field before, and is proof of the great fidelity, zeal, and intelligence with which he has discharged his important work. It must be a standard authority, everywhere, upon the matters of which it treats, and many of his improvements will undoubtedly be adopted by life-saving institutions abroad. Although the increase of range which he has succeeded in securing may not be regarded elsewhere as a matter of so great importance as is attached to it here—in view of the less need of it—a reduction in the weight of the apparatus to be transported to the scene of a wreck will always be an important factor in the improvement of life-saving appliances in all countries.

It was stated in last year's report that the distribution of the breeches-buoy as a substitute for the life-car at wrecks where the boat cannot be used had begun, and this year it has been completed, so that all the stations are now supplied with this lighter means of offering a safe transit to the shore to persons imperiled on stranded vessels, in such cases as require the use of this class of apparatus. Many occasions will still demand the employment of the life-car, especially those where the lives of large numbers on board are involved, and it must not be inferred that the use of this valuable appliance is abandoned, but as in the majority of cases the crews of vessels which come ashore upon our coasts range from five to ten persons, the breeches-buoy is sufficient for their deliverance, and as it is much lighter than the life-car, the facility with which it can be transported to the scene of a disaster makes the advantage of its employment obvious, inasmuch as every lessening of the burden of appliances which the life-saving crews have to drag for considerable distances over yielding beaches is of manifest importance.

The difference in weight between the breeches-buoy and the life-car, including their respective working-tackle, is 550 pounds. Adding to this the difference in weight between the old wreck ordnance and that devised by Lieutenant Lyle, which in the instance of the smaller gun is 210 pounds, and in the larger 110 pounds, the total reduction in the weight of the impedimenta for service at wrecks is 660 or 760 pounds, according to the gun which may be employed. This is a result which is contemplated with much satisfaction.

The law authorizes signals for the benefit of commercial interests, to be provided under the charge of the Chief Signal-Officer of the Army. It also authorizes the establishment of signal-stations at such of the life-saving stations as are suitably located for the purpose, to be operated under joint regulations of the Treasury and War Departments. The co-operation between the Life-Saving Service and the Signal Service, contemplated by the latter provision, has for some time been effected, and former reports have detailed its successive results. Allusion was made in the last annual report to the important advantages anticipated from the establishment of a code of Danger or Distress Signals for communication between life-saving stations and vessels requiring aid. Such a code has now been devised and introduced into the service, in concert with the Chief Signal-Officer, and flagstaffs for the display of the signals have been erected at nearly all the life-saving stations, and the crews under the instruction of the assistant inspectors have acquired commendable proficiency in its use. At such of the life-saving stations as are also signal stations, it is operated by the observers of the signal corps. The code at present is confined to the use of flags, and therefore can only be employed by day, but the Chief Signal-Officer has nearly completed arrangements for effecting night communication of the most important messages it may be necessary to transmit.

A general distribution of the code among merchant-vessels has been effected through the customs officers at the various ports of the country. It is intended, when the station crews shall have become so thoroughly familiar with the use of signals as to warrant such extension of their employment to supply the stations with the International Code complete, which will admit of the transmission of any desirable intelligence from passing vessels to the shore, and the contrary. The advantages to commerce of the complete introduction of this system are apparent, and will increase as telegraphic and other rapid means of communication are multiplied.

The War Department has established for the use of the Signal Service a telegraph-line running along the coast between Cape Henry and Cape Hatteras, in the immediate vicinity of the several life-saving stations in the Sixth District. This office has represented to the Chief Signal-Officer of the Army the desirability of establishing telephones in connection with this line at the several stations, to be operated by the respective keepers, for the purpose of congregating, if necessary, upon occasions of disaster, several crews with their appliances, and also for the ready transmission of orders and information along the entire chain of stations when required. The Chief Signal-Officer has promptly acted upon this representation, and has made preparations for placing immediately telephones at the stations, twelve in number, between Cape Henry and Kittyhawk. These telephones will be in operation this winter, and the season will afford opportunity for testing their value and the feasibility of their general employment at life-saving stations. Should the results anticipated be realized, these instruments will be adopted on other portions of the coast as rapidly as means will admit.

AWARDS OF MEDALS.

A number of medals have this year been awarded for gallantry in saving life. Of these, three have been won by members of the New York Metropolitan Police, under circumstances which reflect peculiar credit upon the recipients.

The first case was that of Patrolman Philip C. Bleil, who, it appeared in evidence, had saved eighteen persons from drowning, between 1860 and 1877. Most of these rescues he effected by jumping at an instant's notice from piers, in his uniform, into the water, often at night and in winter, thus braving the variety of perils involved in mastering the wild struggles of the drowning in the darkness and amidst the floating ice of a half-frozen river. In addition to the persons saved by this gallant officer, was a horse, showing that his active humanity extended even to the brute creation. A medal of the first class was awarded him.

Another case of equal desert was that of Officer Thomas McBride, also of the New York police force, who was proved to have saved from drowning, in his beat along the water front of the East River, eighteen persons

within three years. One case was that of a determined suicide, the rescue being complicated by a violent struggle in the water with one unwilling to be saved. In another instance, the desperate task of the life-saver was to sustain in the midnight river till help arrived a drunken man weighing 300 pounds. A third rescue was that of an intoxicated steamship fireman, effected in February, in water full of floating ice and under a blinding snow-storm, and costing the performer a long and dangerous illness. In one instance he saved a woman; in another a child. Under all circumstances, and in behalf of people of any class or condition, this gallant man risked his life without hesitation. The gold medal of the first class was never more deservedly awarded than to him.

To another New York policeman, Michael Gorman, the silver medal of the second class was awarded for plunging into the East River in full uniform upon two occasions, and on each saving a man. With one of these persons he had a hard struggle in the water against a strong flood tide. Officer Gorman had previously signalized himself as one of five policemen who rescued, at the peril of their lives, nine children from a burning building in New York.

In these exploits against death for the lives of men, the honor of the Navy for gallantry and humanity has this year been worthily upheld in two marked instances. One is that of Ensign Lucien Young and a seaman named Antoine Williams. When the Huron lay heeled over, flooded by the furious sea, and to get a line from the vessel to the shore was the only chance for life left to the survivors, as they clung, already half dead, to the shattered wreck, these dauntless men were the forlorn hope of the occasion. Though the shortness of the line prevented the establishment of the desired communication, they, after a dreadful struggle with the surf, succeeded in gaining the land, and at once, though fearfully exhausted and wounded and battered by fragments of wreckage, fell to work hauling some of their struggling comrades from the breakers, of whom four were saved. Barefoot, his legs bruised and sore, every step hurting him fearfully, Ensign Young then traversed the beach, walking and running, for nearly three miles to the closed station, the door of which he broke in, and from whence he returned to the wreck with apparatus for the relief of his comrades, in whose behalf his exertions to the very last were unceasing. To this indomitable man, who had also on two former occasions rescued life imperiled by the sea, a gold medal of the first class was awarded. The award of the medal in recognition of the equal valor of the seaman Williams, has been delayed until formal evidence in his case can be filed.

The other instance of naval gallantry, which won the silver medal of the Life-Saving Service, was afforded by Masters H. C. T. Nye and J. L. Hunsicker on September 1, 1875, while on duty on board the Coast Survey steamer Gedney, off Monomoy Point, Cape Cod. These alert and brave men, hearing cries for help from the water about ten o'clock at night, rushed up on deck from below, plunged overboard, and suc-

ceeded in sustaining between them, until a boat from the vessel could be lowered, Lieut. James Franklin, of the Navy, who had gone in swimming from the ship, had become suddenly exhausted and been swept astern by the tide, and would undoubtedly have perished but for this timely aid, being insensible when taken from the water, his saviors also being greatly exhausted.

A gold medal of the first class was awarded to John Carey, a brave deck-hand, attached to the Pennsylvania Railroad Company's ferry-boat Central, who on the 17th of May, 1877, leaped from the boat into the North River, swam 200 yards, and grappled with and sustained in the heavy swell of the stream a man named Adolph Gabriel, who had fallen from the rail of the Central Railroad Company's ferry-boat Fanwood, which was passing in the opposite direction, and would have been drowned but for the aid thus rendered. After seizing Gabriel in the water, and subduing his struggles, Carey, with rare energy and mastery, swam with him about twenty feet to a boat which was propelled toward him by an oarsman, clinging to the stern of which, still supporting the half inanimate Gabriel, he was towed with his burden through the water to a tugboat a hundred feet distant. This manly feat was witnessed by hundreds of persons on board the two ferry-boats, a large number of whom united in a declaration that the peril and the daring gallantry involved, merited the highest recognition that could be given by the government. It appears that twelve other lives had previously been saved by Carey. The presentation of the medal to him was the occasion of a striking demonstration at Jersey City, at which appropriate addresses were made by Hon. John T. Morgan, of Alabama, Hon. A. A. Hardenbergh, of New Jersey, and other distinguished gentlemen.

Another rescue was effected on September 17, 1877, by Capt. Charles H. Smith, of the light-house tender Rose. A small boy, named Thomas Walsh, had fallen from a wharf into the Christiana River, at Wilmington, Delaware, and was on the point of drowning in the presence of a number of bystanders, when Captain Smith caught sight of him from the deck of his vessel, which was lying at some distance in the stream, and instantly, without taking off coat, hat, or boots, tumbled overboard, swam up to, seized, and handed up to the people on the wharf the half-drowned child, and then nonchalantly swam back to his vessel, up the side of which he clambered, and went below, soon reappearing upon deck in a dry suit, with the air of a man who had done nothing to speak of. This act of heroism, done so lightly, and in sailor fashion, was justly recognized by the silver medal of the Life-Saving Service.

A gold medal was awarded to John Hussey, a sturdy 'longshoreman, who was shown by the evidence presented to the department to have promiscuously risked his life for others at all times and seasons for thirteen years past, in the surf at Coney Island and the swell of the East River, and during that time to have saved, often under circumstances of great peril and hardship, no less than eighteen persons, and also sev-

eral horses. It is one of the oddities of coincidence that Hussey was the third person receiving a medal during the year who had saved just eighteen lives. The presentation of the medals to this hero and to Officer McBride was made the occasion for an interesting ceremony on the 30th of April last, at the chamber of the board of aldermen in New York, which was crowded with representatives of the city and Federal governments. In delivering the medals, an eloquent and felicitous speech was made by Hon. S. S. Cox.

Medals have also been won by two keepers of the Life-Saving Service. One, a gold medal, was awarded to Capt. Joseph Napier, keeper of Life-Boat Station No. 6, District No. 10, for the daring gallantry he displayed in rescuing the crew of the schooner D. G. Williams, near the harbor of Saint Joseph, Mich., on the 10th of October, 1877. The schooner lay stranded during a heavy gale on the outer bar, with the sea breaking over her, and her unfortunate crew of six men up in the rigging for safety. Captain Napier got together three volunteers, and, taking the boat belonging to the propeller Messenger, pushed out for the wreck. At the first attempt the boat was capsized in the breakers. On the second trial he reached the wreck and returned with two of the sailors. The third trip the boat was completely filled with water by the sea breaking over it, but was bailed, and again reached the vessel, bearing off two men. At the fourth attempt Captain Napier and his three assistants were thrown out of the boat by a furious surge, and one of his legs was badly hurt. One of the men swam ashore; another got a line flung to him from the wreck and was taken aboard; and Captain Napier and the other man, clinging to the boat, succeeded in righting and bringing it alongside the schooner, from whence they took off the two remaining men of her crew, together with the man taken on board, and regained the shore in safety. On other occasions Captain Napier was known to have shown equal heroism on desperate seas, notably in the rescue of the crew of the schooner Merchant in 1854, during a tempest, for which feat he was presented with a gold watch, suitably inscribed, by citizens of Chicago.

Another medal, of silver, was awarded to the gallant keeper of Station No. 5, coast of North Carolina, Capt. Malachi Corbell, for going out in a high wind and heavy sea to the rescue of four colored men who were capsized in their boat while blue-fishing on the outer bar near Caffrey's Inlet, November 25, 1875, several months before he was made keeper of the station. Two of the men were swept off from the capsized boat and drowned, but Captain Corbell succeeded in rescuing the remaining two, though with great peril to himself and his helpers. In returning, his own boat was upset in the breakers, but by the exercise of coolness and courage he succeeded in gaining the land with his fellows and the two men thus twice saved.

A silver medal was also awarded to Edward Nordall, a brave seaman on board the revenue-steamer Tench Coxe, who, on the afternoon of

June 3, 1877, jumped overboard into the Delaware River during a violent squall of wind and rain, which had capsized several yachts, and sustained in a racing current, and saved from drowning, an exhausted man, then on the point of sinking, who had gone overboard from one of these overturned vessels. A few moments previously this noble sailor had assisted in rescuing three other men from the water. His deed can best be appreciated by those who can realize the courage required to plunge into an angry river for a human life, during the confusion and dismay induced by a sudden squall.

DONATIONS OF SITES.

Difficulties of several kinds always arise in the attempt to secure sites, and form one of the chief causes of delay in the erection of stations. Sometimes the ownership of the spot selected is involved in doubt or obscurity; at others there is trouble in obtaining legal title to the ground; and in some cases the owners will demand the most exorbitant price for a patch of property, relatively worthless until sought by the government for a humane purpose. It is pleasant to record, however, in reference to the latter class of instances, that there are a number of examples in which the announcement that the Life-Saving Service found a certain place upon the beach desirable as a site for one of its houses of defense for the shipwrecked, was promptly followed by the donation of the land for this purpose by the owner. The erection of several of the new stations provided for by the act of June 18, and some others, has been, and will be, greatly facilitated by this quick generosity. In this way the service is indebted to Messrs. W. E. and G. Hadlock for the gift of the site for the life-saving station at Cranberry Isles, Maine. That for the relocation of the life-boat station at Oswego, N. Y., is due to Mrs. Elizabeth S. Miller and Greene Smith, esq. The site for the new life-saving station at Ocean City, Md., was donated, at the instance of Hon. George R. Dennis, by Messrs. Hillary R. Pitts, B. Jones Taylor, and George W. Purnell, as trustees of the property; and the service has to thank W. J. Doughty, esq., for the place selected for the life-saving station at Hog Island, Virginia. It is also under obligations to Mrs. Jane E. Gallup, N. H. Baum, esq., Washington S. Stetson, esq., and Jesse Etheridge, esq., for the donation of the respective sites at Paul Gamiel's Hill, Kill Devil Hills, Tommy's Hammock, and Pea Island, upon the coast of North Carolina, where it has been exceedingly desirable to put up life-saving stations as soon as possible. The removal of the life-boat station at Fairport, Ohio, has been assisted by the donation of a desirable site, through the kindness of Hon. H. B. Payne, of Cleveland. Obligations must also be expressed to Mr. and Mrs. Allen Higgins, Henry Gill, sr., esq., Messrs. Charles D. Nelson & Co., Messrs. George W. and Charles M. Alden, and Mrs. Nellie Alden, Mr. and Mrs. Jeremiah Jenks, and Mr. and Mrs. George W. Jenks, for the gift of sites for stations at Bailey's Harbor, Port Austin, Muskegon, Sleeping Bear

Point, and Sand Beach Harbor, Michigan. The city of Manistee, Mich., also donated the site for the life-boat station in that locality. A site for the life-boat station at Ludington, Mich., was presented by the Pere Marquette Lumber Company. Ground for the new life-saving station at Coney Island was given by the New York and Manhattan Beach Railway Company, and the site for the life-saving station at Short Beach was bestowed by the authorities of the town of Hempstead, Long Island. To the persons and corporations named, the thanks and acknowledgments of the establishment are tendered for these substantial evidences of public spirit and humanity.

DONATIONS OF BOOKS.

Fresh evidence of kindly interest in the life-saving crews, and of appreciation of their life of winter solitude upon the coast, has this year been manifested in the form of the donation of books for their use at the stations. These volumes have come from a variety of sources, and in many cases appear to have been sent at the suggestion of an editorial writer in one of the leading New York journals, whose generous pen has often before aided the service. In behalf of the crews, and of shipwrecked persons sheltered at the stations, whose otherwise vacant hours these volumes will solace, the thanks of the establishment are tendered to the donors.

The establishment is also peculiarly indebted to the American Seaman's Friend Society, of New York, for continued efforts in aid of filling the station libraries, in addition to the regular transmission to each crew of their interesting monthly publication, "The Sailor's Magazine," and for hearty co-operation with the service in other important ways.

These acknowledgments would be incomplete if they omitted the honored name of Capt. R. B. Forbes, of Massachusetts, long synonymous with many and varied forms of humane exertion for the welfare and safety of seafarers, and unintermitting benevolence toward all men. He has been for years the active friend and co-worker of this service, which owes to him many benefits, the least of which is the gift, which it is here relevant to mention, of a number of copies of his valuable work, entitled "Life-Boats, Projectiles, and other means of Saving Life," which were ordered for the official use of the establishment, and which he freely sent, declining compensation.

THE ACT TO ORGANIZE THE LIFE-SAVING SERVICE.

The most signal event of the past year in relation to the establishment, was the passage of the bill "to organize the Life-Saving Service." From its inception to its final issue as a law, this bill was attended by a remarkable agitation in its favor among the mercantile and marine classes, and the population of the seaboard, who, so long as the matter was in doubt, never ceased to memorialize and petition Congress for its passage, which at length took place by the unanimous vote of both

Houses, on June 18, 1878. It would seem ungracious not to at least refer to this memorable warmth of interest in the Life-Saving Service, whose future utility, under the increased advantages conferred by this act, may, it is hoped, justify the cordial feeling of the community toward it, and form to its well-wishers and co-workers a substantial and a fitting and noble acknowledgment.

The main features of the act may be briefly described. It provides for the establishment of 37 new stations; 3 of them upon the New England coast, 3 upon the coasts of Delaware and Maryland, 10 upon the Lakes, 6 upon the Gulf coast, and 15 upon the coasts of Virginia and North Carolina. The scope of the operations of the service is thus considerably extended, a new district being created upon the Gulf coast, and undue gaps or spaces between existing stations on other coasts being filled up, notably in those of the Sixth District, where the addition of 10 intermediate stations diminishes to the ordinary distances the stretches of 10, 12, and 14 miles between the stations, which have heretofore seriously increased the hardships of patrol and the labor and delay of reaching wrecks with the necessary burden of apparatus.

The act further provides that all moneys received from the sale of old stations and material condemned by boards of survey may be expended in rebuilding or improving and equipping other stations. Among its subordinate features, it authorizes formal investigations into cases of shipwreck attended with loss of life when they occur within the field of life-saving operations, and bestows the life-saving medal of the second class upon persons making signal exertions in rescuing and succoring the shipwrecked and saving the drowning, these medals previously having been only eligible to persons who had actually endangered their lives in these heroic toils, regardless of hardships or personal losses incurred by them.

The act has five features of great importance, to which all the other provisions are minor and auxiliary. These are the organization of the service into a regular establishment, under the charge of a general superintendent, whose powers and duties are defined by law; the prolongation of the period of active service for the stations, so as to cover the earliest storms of autumn and the latest of spring; the increase of the pay of keepers, and the extension of their functions to include those of inspectors of customs; the more efficient organization of the life-boat service upon the lakes; and the detail of officers of the Revenue Marine to act as inspectors of stations.

By the first named of these measures the service is placed under the undivided charge of an officer whose competency is secured by the enumeration in the law of the qualifications necessary for the position, while his duties and responsibilities are placed beyond evasion by being specifically described.

The provision of the act for extending the term during which the stations are manned and opened for service from September 1, to May

1, of each year, and on the lakes from the opening to the close of navigation, except at points where a shorter period of service may in the discretion of the Secretary of the Treasury be deemed sufficient, is also a measure of great utility. The necessity for a longer term of life-saving aid upon our shores was sadly shown by the case of the Huron, which was wrecked on the North Carolina coast only a few days before the time permitted for the opening of the stations, and, as previously stated, under such conditions as would probably have enabled every person on board to be saved if the contiguous life-saving crews had been on duty. Few wrecks occur upon our seaboard during the bland seasons, and when they do occur, assistance can generally be seasonably improvised; but the arrival of the autumnal and vernal equinoxes is often attended with severe tempests, which cause considerable marine casualty, and the assistance of our gallant station crews may then be as necessary as during the more inclement periods of winter.

The grave apprehensions felt at the date of the last annual report, on account of the dropping away from the service of many of the most skilled and trusty keepers, has been materially relieved by the provision of the act which doubles the annual rate of pay formerly accorded to these officers. It is hoped that the compensation as now fixed, which is $400 per annum, may suffice to keep in charge of the stations the very best specimens our coast affords of these masters of boatcraft and natural captains of crews, who under the operations of the Life-Saving Service are the guardians of seafarers imperiled upon beaches which surf and storm make always dangerous. By the terms of the new law they are also in a wider sense than before guardians of national and private property, their functions as keepers of the stations embracing also those of inspectors of customs, thus enabling them to not only legally care for all stranded goods in the interest of owners, but to prevent smuggling, and insure the collection of revenue upon dutiable merchandise in the interest of the government.

The effective organization of the life-boat service upon the lakes is the fourth principal reform effected by the bill. The restrictions and disadvantages under which this service has hitherto suffered have been detailed at length in the last annual report. The spectacle was there presented of the life-boat crews subjected to the loss of daily wages whenever called upon for the drill and exercise necessary to perfect them in the use of the boats and apparatus, and receiving no compensation in return; subjected, also, to the most strenuous, exhausting, and perilous labors in behalf of distressed or endangered vessels, and getting no recompense whatever for these days of terrible risk and toil upon the stormy water, unless they happened to actually save life; and becoming, in consequence of this experience, disheartened, neglectful of their duties, irresponsive to the calls of marine disaster, and communicating their own official paralysis to the whole life-boat service. It remains to be seen whether the remedies which the act supplies are sufficiently radical

to make the life-boat service upon the lakes equal to all exigencies and worthy of the high traditions which belong to this mode of succor in other countries. By the provisions of the law the several members of the crews are paid $3 each per day for time given to drill and exercise, and a similar sum for saving and guarding property imperiled by the sea; and a sum not exceeding $10 for each occasion of actual and deserving service at shipwrecks. The act has thus greatly improved the status of the service by providing an adequate and equitable recompense for the exertions of these hardy and daring volunteer crews, and it is hoped that this improvement may be all that is desired to secure prompt and efficient relief to wrecked or endangered shipping in that locality.

A fifth feature of the act is in the provision for the detail of Revenue Marine officers as inspectors of the stations. The great experience of these officers in coast navigation, and the twofold knowledge of sea and shore they have drawn from their pursuits as agents of the revenue, make them peculiarly fit for the duties involved in seeing that these semi-nautical establishments, the stations, are ship-shape, and their crews properly disciplined, skillful as surfmen, and proficient in the drill which enables them on the occasion of a disaster to use the wreck artillery with precision, set up the hawser and hauling lines, work the life-car or breeches-buoy, and make use of all the appliances provided for rescuing endangered persons caught in the terrible snare of the surf. A marked advance in the *personnel* of the station crews and the order and effectiveness of the several stations has already resulted from the labors of these officers.

These several measures have been strongly urged for some time by the department, and their incorporation into the law of the Life-Saving Service puts the establishment upon a fairer footing than has hitherto been accorded it, and must greatly increase its efficiency. It is certain that the beneficent results of this legislation have already been apparent upon all our coasts, especially in regard to the earlier opening of the stations, the provision for which was exceedingly opportune, inasmuch as the fatalities consequent upon their being closed would this season have been unusually numerous. It is equally certain that the stimulus of the law has been felt by all the agents of the establishment, for the labors of the crews this fall have been extraordinary, and show that they have voluntarily made efforts and braved hardships which can only be attributed to the zeal thus inspired. They have effected midnight rescues under circumstances of marked peril from gale and sea. On the lakes, volunteer crews have continuously kept watch by night and day upon the beaches and the wave-swept piers, as they were not required to do, and in some cases they have done this for days together, almost without sleep, and without ever changing their drenched garments, their headquarters being boat-houses without stoves, and so cold that their occupants were compelled to keep awake and in motion. Here

and on the seaboard their exertions have been strenuous, and the record of the season since the recent opening of the stations, whatever it may be at its close, has been unquestionably remarkable, showing, as it does, the salvation of many lives and a great amount of property.

To illustrate their spirit and also to give some idea of the nature of the services which the life-saving crews render, a concise statement is given in another part of this report of the work they have done upon occasions of casualty or disaster under the operation of the act or since the opening of the present fiscal year up to this date, a period of five months, or rather, the season when dangerous storms are liable to occur being taken into account as the true limitation, a term of somewhat less than three. It must be borne in mind that these services have been mainly rendered in a period which upon the seaboard is the least perilous of the active season as now constituted, the severer tempests of winter and of early spring being yet to ensue—a period which has hitherto been estimated as of so little hazard to vessels upon the Atlantic coast that no provision was made for the opening of life-saving stations until near its termination; consequently, this narration does not fully or fairly represent the character of the services of these men when cold and sleet and snow enter as elements into the obstacles they have to encounter. But that the season referred to was really fraught with peril to shipping and to the lives of seafarers, the statement given of the services performed by the life-saving crews amply shows; while the same statement brings into notice the labors and dangers involved in the aid and succor happily rendered, and is also an earnest of the work which may reasonably be expected from the cordon of surfmen upon our coasts when the rigors of winter put them on their mettle. The increase in the number of the disasters as the season advances, beginning at 4 and 6 in the months of July and August, severally, augmented to 16 in September, to 35 in October, and also 35 in November—an average of more than one per diem—will be observed; while their corresponding growth in seriousness, involving more perilous effort, will also be apparent.

Up to the present time, among the exceptionally great number of disasters which have taken place upon our coasts, there has been only one serious calamity, that of the wreck of the ship A. S. Davis, at Cape Henry, in the Sixth Life-Saving District, on the 23d of October, whereby 19 persons perished, and this is an instance where nothing could be done, because the ship went directly to pieces. There has seldom been a demolition of a vessel so rapid and incredible as in this instance, as there has rarely been a tempest of such hurricane fury. At two o'clock, when the ship struck, the wind was blowing 84 miles an hour. This means a blast in which no man can stand upright, but which throws him head over heels if he tries it, and it also means a surf of enormous power and magnitude. Add to this the darkness, the chaos of rain and sand, and the impenetrable gloom, filled with the monstrous bellowing of the tem-

pest. The ship was new and built with a massive strength, such as yields ordinarily only to the protracted battering of many hours in the surf, yet in one moment it was practically all over with her. At the first tremendous shock of her striking, the sea abaft arose and fell with the force of hundreds of tons upon her, at one stroke tearing away the stern. Her appalled crew took instantly to the rigging for safety. The next moment the sea rushed through the crushed after-works into her hull, which it rent in twain. In a few minutes the vessel was in pieces, her mighty framework, which had been tenoned and bolted with all the art of the shipwright, wrenched asunder; the stout oak timbers bent, split, and twisted as though they were fagots, and her crew, mutilated corpses, whirling in the deep, save one man, from whom the sea tore his clothing, and flung him alive upon the sands. Yet in this indescribable convulsion of nature, the gallant patrolman, Atwood, faithfully kept his march so long as he could stand. The ship was still at sea, but on her fearful race for the shore, when he staggered, half beaten down by the gale, past the point set for her destruction. Had she been there then, he could not have seen her, nor could he have heard in the deafening roar of the surf and wind the cries of dismay from her rigging. Tottering on, repeatedly thrown down with violence by the hurricane, he was at length obliged to lie prone and wait for the subsidence of its fury, and it was only when he returned upon the same beat later that he knew by the fragments of wreckage which strewed his path that a vessel had been torn to pieces there in the darkness. This is the only instance thus far in the year where life-saving energy has been limited, as in this case it was of necessity, to the indomitable persistence of the patrol, and in every other there has been vigorous and successful service, on the beach and in the boat, for the rescue of endangered lives.

In a spirit kindred to that which animates these crews, and with high designs and hopes, the service, enlarged by the law, and re-enforced by it with stronger powers and fresh resources, enters upon what may be considered a new career. Yet if great expectations can be reasonably based upon the important advantages which the act has conferred upon it, it is equally reasonable to lower anticipation in view of the preliminaries to successful action which more or less remain to be established, and the contingencies which may always arise to cause disaster. It must first of all be remembered that the serious task is laid upon the chief officers of the establishment to perfect in the older districts and to create in the new, out of the relatively coherent or the absolutely crude materials under their hands, such an organization as can really deserve the name of a service. The work is similar to that of a military commander who, from a mass composed of some veteran troops, augmented by fresh levies and many raw recruits, has to weld together the martial force which can truly be called an army. What can really be done in this wa yis ustrated by the condition of the districts which have been

longest in operation. Let us take that, for example, on the coast of New Jersey, where familiarity with the methods and appliances adopted by the establishment for saving life, and confidence in them on the part of the crews, derived from their knowledge of the marvelous work that can be performed with them, exist in full measure; where, moreover, for twenty years prior to the regular formation of life-saving crews, and the introduction of the present system, some of these methods and some of these appliances (the latter, of course, since greatly improved) had been in use at improvised efforts to succor the shipwrecked, and at other times had been subject to discussion and experiment; and where, in addition, the beachmen had means, which few sections of the seaboard afford in equal measure, of becoming intimate with the nature and action of the surf in tempests, and of devising expedients for attempts to encounter its fury at frequent scenes of disaster. Now, upon this coast, the statistics of disaster since the organization of the present system in 1871 disclose the following remarkable record, due to the antecedents and conditions just indicated. Within the period mentioned, there have occurred in this field of action 180 disasters, the number of persons on board the vessels involved being 1,909. Of these persons only 18 were los—tless than one per cent. of those imperiled, and an average of a fraction over two lives per annum! The manner in which these 18 persons perished exists in the annals of the establishment, and could, if necessary, be given to the minutest particular. During these seven years the most thorough and impartial investigation was made into the circumstances of every disaster attended with loss of life, and it was found that, with a single doubtful exception, not a life was lost which it was within the possibility of human effort to save. The whole number lost in these 180 instances is but a tithe of the sacrifice which a single disaster often previously involved upon the same coast. This, in a locality in former years proverbially the most dangerous of our seaboard, and within whose limits lie buried more skeletons of ships than the sands of any other two districts combined contain. The record shows what may be achieved when organized effort is aided by time.

Such success, it is manifest, cannot be expected in newly-created districts. In all districts there is continually much to learn and many obstacles to overcome. The case may be cited of a navy which had won many victories with the old men-of-war, suddenly called upon to fight in Monitors. A formidable prejudice, formed by long experience in the superseded vessels, had here to be conquered. In our service we start with the great advantage of crews who are no conscripts to the surf, but skilled in the use of boats with which they are accustomed from boyhood to surmount it. These boats, however, are their own, built upon a model to which they are used. The introduction of another style of boat, far better than theirs, and scientifically devised to live in the most dangerous seas, causes them the gravest misgivings and even fears. Only its use upon some occasion when necessity compels, and when

they first learn with amazement of what work it is capable, establishes their confidence. An instance is at hand where the veteran crew of a station in one of the older districts were supplied with a boat of this description. No terms could express the mistrust, contempt, and even disgust with which the new craft inspired them. To visitors at the station they openly covered this object with opprobrium. But the time came when a disaster summoned them to go out through a furious surf to the rescue with this boat; upon this occasion they first learned what the despised surf-boat could bear and do; and to-day, for them, there is nothing floating to compare with it in the world.

When even in the older districts such obstacles exist and constantly arise in the path of the creation of an efficient service, the case may be imagined in the new, which the act assists to form and develop. As already said, we start with the advantage of having for the crews skilled surfmen, and used, at least, to row their own boats through the surf. But all else they have to learn, and only through long drill and discipline can they reach the required standard. They must acquire familiarity with the better boats supplied them; they must become adepts in the use of wreck-ordnance; in the art of setting up hawsers and hauling lines, and setting down crotch and sand anchor; in the employment of signals; in the toilsome ordeals of night-patrol upon desolate beaches in every variety of weather which winter can pour upon them. Until all this is gained, the service upon their coast has not reached the true stature of a service. Only where there is proficiency can there be efficiency; and failures at scenes of trial must, therefore, be reasonably expected, and met with forbearance and patience. Still further, and to cover the case of every district, let it be said that little is as yet known and still less realized of the stern work it is to save life at certain times from shipwreck upon our coast. There are nights of storm and darkness upon our beaches, as every man in every station knows, in which, as in the case of the A. S. Davis, if a vessel drives ashore no help can be rendered, and every one on board must perish, though the beach were dense with stations and their crews. These are the black nights of hurricane, in which man is powerless. The flying sand, the driving rain and hail, the thick darkness, the overthrowing wind, the furious surf flooding and spreading in all directions, the amalgamation of all elements, the overpowering horror and confusion of tempest, at such times paralyze the very thought of action. Yet if in such an hour a great shipwreck, involving the loss of a hundred lives, should happen, as it might even within hailing distance of a station, how few, amidst the stupendous uproar against the Life-Saving Service, would know that in that hour it was the impossible that had confronted human effort. The reflection that the hard conditions do exist under which the most skilled and gallant life-saving crews may fail in their endeavor, should at once temper the absoluteness of confidence in their prowess, and mitigate the severity of censure upon their failure. Still

more, this is a service in which, when the utmost effectiveness is established, and all conditions for success are assured, the parting of a line in some unusual strain, the slipping of the foot of the steersman, the defection of a keeper or a surfman till then trusted, may prove the unexpected co-efficient of fatal disaster. In one word, the usual margin should be allowed for accident and frailty incident to all human arrangements, and which no legislation, however wise or generous, nor any contrivance, can wholly forestall or prevent. It is the glory of the Life-Saving Service that up to this date its crews have in nearly every instance successfully grappled with obstacles. How greatly they have reduced the quota of coast disaster within the last seven years, until its once swollen mortality is now a mere attenuation, has become a familiar story. No service has a smaller percentage of failure; and this fact should be treasured against the evil day, should that day arrive, when loss, either by fault or chance, shall fall upon the record of the establishment.

ACKNOWLEDGMENTS.

The establishment is under great obligations to the Life-Saving Society of Russia for the munificent donation of twelve cases of line-carrying rockets, which arrived during the year.

Thanks are continued to the officers of the Royal National Life-Boat Institution of Great Britain, and to those of the French Central Society at Paris for Saving the Shipwrecked, for the receipt of valuable publications.

Cordial acknowledgments are due to Mr. W. D. O'Connor, the Assistant General Superintendent of the service, to whose care the conduct of its affairs devolves in the enforced absences upon official duty of its principal officer, and to whose varied talents and executive fidelity the establishment is much indebted.

The Chief Inspector, Captain J. H. Merryman, has discharged his numerous and incessant duties with his usual clear intelligence and indefatigable energy, and the service has in a great degree been kept up to the required mark by his constant care and effort.

Captain John McGowan, who has, in conjunction with him, supervised the construction and repair of the station buildings, also deserves special recognition for the energy and faithfulness with which he has discharged these functions.

The marked efficiency with which Captain J. W. White, of the Revenue Marine, has discharged the numerous and laborious duties of Assistant Inspector and Acting Superintendent of the life-saving district upon the Pacific coast, merits hearty and special acknowledgment, particularly in view of the fact that these duties are only a part of the serious burdens imposed upon him.

Lieutenants Walter Walton, Charles F. Shoemaker, William J. Herring, Thomas D. Walker, and W. C. De Hart of the Revenue Marine, have rendered excellent service as assistant inspectors in the several dis-

tricts, by which their efficiency has been materially advanced. Similar service, since the expiration of the fiscal year, has been well performed by Captains John Carson, George R. Slicer, David Evans, Daniel B. Hodgsdon, Eric Gabrielson, Russel Glover, and Lieut. Charles H. McLellan. The commanding officers of many of the Revenue Marine vessels have also aided the service in various ways.

Good words are no less deserved by the Superintendents of the respective life-saving districts, who have all fully done their duty.

The work of conducting the physical examinations of keepers and crews, and instructing the men in the art of resuscitating the apparently drowned, has been thoroughly performed by Assistant Surgeons H. W. Sawtelle, H. M. Keys, and G. W. Stoner, whose valuable services were received through the courtesy of Dr. Woodworth, Surgeon General of the Marine Hospital Service.

The new stations which have been built during the past fiscal year and since that time, were designed, with considerable improvements and additions, by Mr. J. L. Parkinson, architect, whose taste and skill in this respect merit recognition.

SERVICES OF LIFE-SAVING CREWS

FROM

JULY 1, 1878, TO NOVEMBER 30, 1878.

SERVICES OF LIFE-SAVING CREWS FROM JULY 1, 1878, TO NOVEMBER 30, 1878.

FIRST DISTRICT.

On August 17, the keeper of Station No. 4 discovered the schooner *D. M. French*, of Barnstable, Mass., stranded during a fog on Brown's Ledge, near the station. Signaling for his crew, he obtained five men, who rowed out to her, kedged her off through the ledges, and ran her into Seal Harbor on to some flats, where her damage could be ascertained at low water, thus delivering her with her crew of five men from a perilous position.

On September 14, a patrolman of the same station saw, at 6.30 a. m., through a lift in the fog, the schooner *George B. Ferguson*, of Belfast, Me., at anchor in the breakers near Red Ledge, Wheeler's Bay. She had struck upon the ledge, but came over and dropped anchor. The sea was rough, and the daring crew of the station who pulled out to her had to constantly watch and dodge the seas which threatened to ingulf them. After a great deal of hard work, which lasted till noon, and with the aid of a small fishing-steamer, not powerful enough to tow the schooner, but which held her to windward with a line, the station crew ran her out of her dangerous position in the breakers, got her into deep water, and left her standing out to sea under full sail. She had five men on board.

An hour later, the same crew saw the schooner *David Faust*, of Ellsworth, Me., making signals of distress through the fog, and pulled out to her. They found her with 60 fathoms of chain out, and her crew unable to heave up the anchors, the chain slipping and the windlass giving with every plunge of the vessel under the action of the wind and sea. The life-saving crew put tackles on the chain to relieve the strain on the windlass, and after a couple of hours' labor the anchors were hove up and the vessel got under way.

On October 10, the keeper and two members of the crew of the same station saw the schooner *Commodore*, of Bath, Me., at 10 a. m., dragging her anchors and drifting toward the rocks in a westerly gale and rough sea off Seal Harbor, three-quarters of a mile from the station. Without waiting to gain the station and alarm the rest of the crew, the three men launched a small boat and in twenty minutes gained the vessel. There were but two men on board, both in great confusion and alarm, and unable to get her anchors up without assistance. The other members of the life-saving crew soon arrived, and in two hours they got up the anchors, beat the vessel into harbor to a safe berth, cleared the fouled anchors, moored, and left her safe.

The same crew, on October 17, while occupied in mortar drill upon the beach, at noon, caught sight through the fog of the schooner *Lucy Jane*, of Rockland, Me., anchored in great danger among the breakers of Brown's Ledges. The vessel had got among the ledges in the fog, endeavored to get out, but seeing the breakers, dropped anchor, thus increasing the peril of her position. Her crew were four in number, and there were two passengers. In twenty minutes the life-saving crew had

boarded her, and in the course of an hour got up her anchors and worked her safely through the ledges into Seal Harbor.

On October 20, the same crew saw the schooner *Mary E. Parsons*, of Islesboro', Me., which had been injured by collision with another vessel, anchor at flood-tide in a northwest gale and rough sea on Burnt Island Ledge, where she would have grounded at low water. Seeing her danger, they launched the surf-boat, boarded her, and got her into deep water to leeward of the ledge, where they anchored her, and set to work to repair her split sails. There were but two able-bodied men in her crew, the others being an old man of seventy and a boy. She was left that night with instructions to her master to keep a light burning, and if new danger developed to show his red signal lantern to the shore. The patrol watched her sharply through the night. The next morning another vessel's crew was obtained to beat her into harbor, the life-saving crew being obliged to go to the wreck of the schooner *Wreath*.

The schooner *Wreath*, of Ellsworth, Me., with four men on board, had stranded at six o'clock on the morning of October 21, on Long Point, Spruce Head Island, in a strong northwest wind and rough sea. The work done by the life-saving crew upon reaching her, which was about half past eight, consisted in shifting her deck load to ease her and running out lines. She was got off by a steam-tug which had been sent for.

On October 24, at 1 o'clock a. m., the schooner *Anna Frye*, of Pembroke, Me., stranded in an easterly gale and rough sea near Wood Island Harbor, where she pounded to her injury, knocking off her shoe, breaking rudder-post, and losing rudder. The crew of station No. 5 boarded her, hove up her anchors, got her off at flood tide, steered her by her sails into Biddeford Pool, and hauled her to the wharf. Five men were on board.

On November 4, the crew of Station No. 1 rescued a man from a capsized sailboat in Quoddy Bay. When found, the man was lying insensible, with his arms across the gunwale of the boat, just about to drop off, and it took two hours' active treatment with hot rocks, blankets, and brandy to restore him to consciousness when brought to the station.

The schooner *Arianna*, of St. John's, N. B., stranded at 11 a. m., November 18, in an easterly storm and heavy sea, on Burnt Island Ledge, Seal Harbor, and was promptly boarded by the crew of Station No. 4, who got her off with the loss of her forefoot and part of her keel, and took her to a safe anchorage. She had a crew of seven men.

On November 22, at 4.30 a. m., the schooner *Caroline Knight*, of Rockland, Me., stranded on Straw's Point, a quarter of a mile east of Station No. 6, and was seen by the patrol within ten minutes afterward. The surf-boat pulled out to her against a strong east wind, and rescued her crew of five men.

On the same day, at 7 a. m., the schooner *Sea Queen*, of Franklin, Me., with four men on board, stranded one mile east of the same station, and as a heavy storm was approaching, and she was anchored in among the ledges where she had already struck three times, she would soon have gone to pieces. The life-saving crew boarded her, slipped her cables, and ran her into Rye Harbor, thus saving her with slight damage.

On the same day the crew of Station No. 1 boarded the schooner *Guiding Star*, of St. John's, N. B., which had stranded, with four men on board, in an easterly gale and heavy sea, in Quoddy Bay, rehung her rudder, which had become detached, made sail at high tide, and floated her off into deep water.

On November 23, the crew of Station No. 4 found the schooner *Mary A. Rowland*, of Bangor, Me., on the rocks, full of water, at Rackliff

Island, in a northeast gale and rain-storm and heavy sea, and took off her three men by boat. Afterward they worked for several days to get her off, succeeded, and grounded her safely on the flats.

On the same day, this crew kedged the schooner *Polly*, of Rockland, Me., off the rocks, made sail, and took her to a sheltered part of the harbor, where they anchored and left her. Two men were on board.

SECOND DISTRICT.

On September 27, the schooner *Water Lily* of Dennis, Mass., stranded at 5 o'clock p. m. near Station No. 5, running so well up on the beach that the two men on board were able to jump ashore, with no other damage than getting wet. The vessel was seen by the patrolman when coming on to the beach, and the life-saving crew hastened to the spot. The men were taken to the station, given dry clothes, and sheltered for two days, when the keeper obtained free passes for them on the Old Colony Railroad. The vessel went to pieces, but not before the life-saving crew had secured her sails, anchors, and rigging.

On the morning of the 8th of October, the crew of the sloop *Teaser*, of Swampscott, Mass., consisting of three men, came to Station No. 3, reporting that their vessel had become disabled the night before in passing Gurnet Point, and that they were obliged to anchor in Saquish Cove, not being able to proceed further. The keeper and crew of the station went on board of her, repaired her damages, piloted her out beyond the point, enabling her to proceed home.

On October 13, the crew of Station No. 13 launched their boat at 10 o'clock a. m. in a northeast gale and rough sea, pulled out, and brought ashore four men who had been rescued from the wreck of the schooner *Tunis Depew*, of Hyannis, Mass., by another vessel, took them to the station and sheltered them until passes could be procured to take them to their homes by the Old Colony Railroad.

On the same date, the crew of Station No. 14 (Nantucket) discovered through the rain, mist, and drifting sand, at about 6 o'clock a. m., the schooner *Clara Jane*, of Lubec, Me., at anchor about a mile from the shore, with both masts cut away. The gale was so violent that the station men in transporting the surf-boat to the scene had difficulty to prevent it being blown off its carriage. After a strenuous effort to reach the wreck, which was at a distance, with the wind and sea against them, the keeper concluded to land and proceed to the boat-house of the Massachusetts Humane Society, which was nearer the vessel, intending to use the boat there. Upon arriving, he found a party of wreckers already assembled, with whom his crew united, and proceeded to the wreck, which was found in good condition, with the exception of her masts being cut away, and anchored in 6 fathoms water.

On the same date, the crew of Station No. 13 saw, at 8 o'clock a. m., the schooner *Joseph Story*, of Gloucester, Mass., scudding before the gale, with one man lashed to the rigging, and a signal of distress flying. This man had been left on board as keeper, the captain and crew having gone ashore, and the vessel meanwhile had parted her chains and gone adrift. She presently struck heavily on the outer bar, with the sea breaking over her, and the life-saving crew pulled out at once, rescued the man, who was quite exhausted, took him to the station, gave him hot drinks, and put him to bed.

On the same day, the crew of Station No. 12 boarded the schooner *T. & C. Hawes*, of Chatham, which had stranded in the night in a northeast gale and rough sea, having dragged her anchors until she grounded.

Her crew had left her anchored and were in Chatham at the time, the station-men finding no one on board of her. The life-saving crew got her afloat, carried her into deep water, and anchored her where she was safe.

On November 24, at midnight, the schooner *Marietta Steelman*, of Somer's Point, N. J., with seven men on board, was run into off Chatham, Cape Cod, by an unknown vessel, and had her starboard main chain-plates, rigging, and maintop-mast carried away and the top of her house stove in. The crew of Station No. 12 went out to her at seven o'clock the next morning, repaired these damages as far as possible, and got the vessel on her way by two o'clock in the afternoon.

On November 26, the crew of Station No. 2 boarded the schooner *Sparta*, of Winterport, Me., which had stranded on Ipswich Bar, five miles from the station, found the vessel filling with water, and aided the crew in heaving off her deck-load and getting her afloat and in tow for Ipswich, where they hauled her alongside the wharf and made her fast.

The crew of Station No. 1 boarded, on November 28, the schooner *William Carrol*, which had stranded at North Island in a heavy surf four miles from the station. Their laborious row was fruitless, as they found that the schooner's crew had already been taken off by others before they could reach her.

THIRD DISTRICT.

On August 5, a portion of the crews of Stations Nos. 6, 7, and 8 went out and rendered some assistance in floating off the steamer *Blackstone*, of Baltimore, which had stranded at half-ebb tide in the fog about 300 yards from the shore.

On August 15, the keeper of Station No. 1 (Narragansett Pier) discovered the schooner *Armenia*, of Tuckerton, N. J., on Whale Rock, West Bay. She had dragged her anchors in a heavy sea, and struck upon the rock at midnight. The concussion threw down the captain, breaking his arm below the elbow and injuring his hand severely. The keeper of the station got together his crew, and succeeded, after much labor, in saving the six men on board, together with their clothing. The vessel was lost.

On September 1, the crew of Station No. 3 went to the assistance of the schooner *Rebecca W. Huddell*, of Philadelphia, which had stranded, at 10.30 p. m., in a thick fog, on the western side of Block Island. There were seven persons on board. The vessel was got off the next day.

On September 2, and 3, the crews of Stations Nos. 6 and 7, and a portion of the crew of Station No. 8, worked the best part of these two days in getting afloat the schooner *Hattie V. Kelsey*, of New Haven, Conn., which had run upon the bar in a thick fog near Station No. 7. They first conveyed the captain's wife and family and their effects on shore, then returned and engaged in the heavy labors incident to working a vessel off into deep water, sticking by until successful. There were eleven persons on board.

The life-saving crew of Station No. 23, on September 14, at one o'clock in the afternoon, saw the yacht *Foam*, of Babylon, N. Y., with two men on board, capsize and come ashore through the breakers on Fire Island, in a heavy sea. They immediately went to the assistance of the men, who were somewhat injured by being struck on the head by the boom when in the water, cared for them, and, after four hours' work, got the yacht off and anchored her in the inlet.

On October 17, the crew of Station No. 33 pulled out and took off five

men from the wreck of the schooner *Greenbury Willey*, of Seaford, Del., which had parted her cable, become unmanageable, and finally stranded in a heavy sea, at two o'clock in the morning, on the south side of Main Inlet. The wreck was total.

On October 21, the crew of Station No. 30, assisted by the crew of Station No. 31, went to the rescue of two men, capsized in the sloop *Cora*, of Bay Ridge, at nine o'clock a. m., one mile east of Hog Island Inlet. They afterward pumped out the vessel, stripped her, launched her in the surf, towed her into the inlet, and rigged her.

On November 5, the crews of Stations Nos. 27 and 28 boarded the schooner *Gazelle*, of Patchogue, N. Y., which had stranded one and a half miles from the latter station, with three men on board, whom they rescued. Before the vessel broke up, they succeeded in stripping her of her sails and rigging and saving a portion of her furniture.

On November 22, the schooner *William H. Hopkins*, of Mystic, Conn., with seven men on board, stranded at five o'clock in the morning, half a mile west of Station No. 31, in an easterly storm and high sea. The station-men went out in the surf-boat and brought the crew safely ashore. The men from Station No. 32 arrived later and rendered assistance at the wreck.

On November 23, at 7.30 a. m., the crew of Station No. 23 discovered the sloop *Alert*, of Patchogue, N. Y., stranded a mile east of Fire Island light, in an easterly gale and high sea. They pulled out immediately, and found no one on board the sloop, which had evidently dragged her anchors from some distant point. The station crew threw over her ballast, at high water hove her off, put her in a safe anchorage, and notified the collecter of the port by telegraph of the occurrence.

On the same day the schooner *Ida B. Silsbee*, of Patchogue, N. Y., stranded on Fire Island Bar, in a westerly gale and heavy sea, with three men on board. The crews of Stations Nos. 23 and 24 boarded her, took off her crew, and threw overboard her deck-load of brick to ease her, hoping to get her afloat at high water, but she pounded her bottom out before the tide swelled.

FOURTH DISTRICT.

On July 7, the crew of Station No. 40 boarded the schooner *Electa Bailey*, of Philadelphia, which stranded at 6.30 a. m., and rendered assistance in getting her off.

The same crew, on July 25, pulled out and landed the crew of three men and their effects from the wreck of the schooner *Peerless*, of Port Jefferson, N. Y., which struck and sunk on Crow's Shoal.

On July 26, the crew of Station No. 39 went out in their boat in a heavy sea, and succeeded, with great difficulty, in taking off four men from the schooner *Imogene Diverty*, of Camden, N. J., which stranded in a gale at 3 o'clock a. m., and finally sunk on South Bar, Cold Spring Inlet.

On September 4, the crew of Station No. 23 went to the schooner *Ann Scannon*, of Philadelphia, which had run upon a shoal at noon, and, after over three hours' difficult and perilous effort, succeeded in taking from her five men and a woman, the sea being very rough, and the vessel, which was slowly sinking, lying in an unfavorable position, that is, with her stern to the sea, which compelled the crew to take the rescued persons down over the bow.

The crew of Station No. 40, on September 27, rowed out to render assistance to the schooner *Brutus*, of Grovesville, N. J., which had stranded, with seven men on board, on the south end of Crowell's Shoal, at low tide, and hove her off at the flood.

On October 22, the schooner *Samuel Carlton*, of Bridgeton, N. J., with four men on board, coming in for harbor, and not able to work ahead on account of the heavy gale and rough sea, anchored, dragged her anchors, and stranded on the north side of Barnegat Inlet at 7.30 a. m., with two feet of water in her hold. The crew of Station No. 17 went out to her, and by running out anchors and heaving with every high tide, succeeded, after four days' labor, in getting her off.

On October 23, the sloop *Mary A. Mott*, of Tuckerton, N. J., parted her moorings in the stress of the gale, and drove up on to a meadow one mile north of Station No. 17, at 5 o'clock a. m., high tide. Shovels were procured from Tuckerton, and the station crew dug her down to low-water mark, and after two days' labor succeeded in heaving her off. There were eight men on board.

The gale of October 23, it will be remembered, was extraordinary, and the sea was terrible. At Station No. 36 its ravages were felt peculiarly. The sea at 5 o'clock in the morning rushed in, wrenched the house from its foundations and burst in at the windows, flooding the interior. The station crew, in danger of their lives, were compelled to row out of the building in the surf-boat, and took refuge in the light-house, half a mile distant. At half past eight, the water having somewhat abated, the crew returned to the station, and discovered the schooner *H. T. Potter*, of Middletown, Conn., stranded one mile south of Hereford Shoals. The sea was at that time running terribly, but the surf-boat was launched, and an attempt made to reach the vessel, which lay 800 yards from the beach. The boat got out through the surf with difficulty and danger, about 400 yards, when it filled nearly to the thwarts, and was forced back to the shore. Another attempt was made shortly afterward, but was baffled by the heavy sea and the floating wreckage. At the third effort the wreck was reached, and four men out of the crew of six were safely landed. The two others had been washed from the rigging and drowned when the vessel first struck.

The schooner *Sarah Clark*, of Greenport, N. Y., was laboring in the same gale, with the seas continually sweeping her deck, when, at 5 o'clock a. m., the fore-hatch covers were washed off and the water began to pour in. An attempt was made to put the vessel before the wind in order to batten down the hatch, when the deck-load broke adrift, and the crew fled aft for safety. The water soon filled the schooner through the open hatches, she became water-logged and unmanageable, rolled down upon her beam-ends, during which position the mate was washed overboard and lost, and a seaman was struck dead by a floating timber, which also knocked him overboard. In a short time the masts broke off and the vessel righted. Land was seen soon after, and at half-past seven the vessel stranded one mile east of Station No. 31, where she was discovered by the patrol, and the surf-boat went to the rescue, bringing in, after a perilous effort, the four survivors.

On the same date, the schooner *William Collyer*, of Providence, R. I., stranded, at 9.45 a. m., half a mile north of Station No. 19, and was lost. The life-saving crew were on hand with their apparatus, when the schooner struck. A line with a buoy attached thrown from the schooner was caught by one of the surfmen, who was held by a cord as he went into the surf up to his waist for it. A hawser was fastened to it, drawn aboard, made fast and hauled taut, and four men from the schooner slid down into the arms of the station men and were passed on shore. The fifth member of the crew had previously been washed overboard and drowned. The work of deliverance occupied one hour.

The sloop *Sarah B.*, of Tuckerton, N. J., went ashore, on the same

date, with two men on board, and on the next day was dug out and got off by the crew of Station No. 24.

The crew of Station No. 23 brought ashore a man, his wife, and little girl from the sloop *Adrienne*, of Tom's River, New Jersey, which stranded in the same storm on Short Beach, and subsequently got off the sloop without damage.

On November 1, the crews of Stations Nos. 17 and 18 went out to the schooner *Lady Ellen*, of Providence, R. I., which had gone ashore in an easy sea, on the south point of Barnegat Shoals, pumped her out, there being four feet of water in her hold, and got her afloat at flood tide. Her crew was composed of five men.

On November 2, the crew of Station No. 24 went to the assistance of the schooner *Dick Williams*, of Philadelphia, which had stranded in a smooth sea, on Little Egg Harbor Bar, with seven persons on board, got her off, and carried her into Egg Harbor Inlet.

On November 9, the crew of Station No. 33 found the sloop *Jordan*, of Patchogue, N. Y., ashore on Corson's Inlet Bar, at 10 o'clock p. m., reached her in the surf-boat at midnight, ran out her anchor into deeper water, and hove her off at flood tide. There were three persons on board.

On November 10, the crew of Station No. 38 went on board the schooner *Barnett Jones*, of New York, which had stranded at Cold Spring Inlet at 7.30 a. m., with six persons on board, and worked her off.

Later in the day, at 3.30 p. m., the same vessel again stranded, this time on Evil Presence Shoal, a mile and a half from land, and was boarded by the crew of Station No. 40, who aided to get her afloat.

The crew of Station No. 1 assisted in getting afloat the sloop *Star*, of New York, which stranded, with three men on board, on November 23, 100 yards north of the government dock at Sandy Hook, New Jersey.

On November 24, the crew of Station No. 17 boarded, with the surf-boat, the sloop *S. E. Dunn*, of Camden, N. J., which had stranded, with nine men on board, three-fourths of a mile east from the station, and, after several hours' labor, got her afloat.

On November 26, the crew of Station No. 40 assisted in getting afloat the schooner *J. Ricardo*, of Philadelphia, which had stranded three-fourths of a mile from the shore, at low tide, on a shoal.

FIFTH DISTRICT.

The schooner *William A. Low*, of Perth Amboy, N. J., stranded on September 15, on the southeast point of Cobb's Island, at 8 o'clock a. m. The crew of Station No. 7 rowed out to the vessel immediately, and the next day, the tides favoring, ran out her anchors and hove her off without damage. There were four men on board.

SIXTH DISTRICT.

The destruction of the *A. S. Davis*, previously described, is the only wreck thus far in the record of the Sixth District, coasts of Virginia and North Carolina. But on November 17, the Swedish bark *Franklin* was reported ashore six miles from Station No. 3. The station crew launched the surf-boat, cleared the breakers with difficulty, there being a heavy surf, and rowed out, through a thick fog, to the vessel, which they found not ashore, but at anchor in shoal water, the captain having made some miscalculation. The keeper gave him instructions as to his position and how to escape from it, landed, and kept a watch from the beach upon the vessel until she got under way the next morning.

SEVENTH DISTRICT.

It will be remembered that the conformation of the shore upon the eastern coast of Florida is such that escape from stranded vessels is generally easy, and that the main danger to which shipwrecked crews are exposed is that of dying from hunger and thirst, the coast being singularly arid and desolate. Instead, therefore, of life-saving stations, provisioned houses of refuge, established at certain intervals, are here called for, the uses of which are exemplified in the two instances of shipwreck which have occurred in that locality since the 30th of June last.

The first is that of the brig *Alexander Nickels*, of New York, which stranded and went to pieces in a terrific hurricane a mile and a half south of New River on September 7. Of the nine men on board, four were lost. The remaining five, after wandering over eight miles, arrived at House of Refuge No. 5, completely exhausted, almost without clothing, and one man, in fact, entirely naked. The captain, who was one of their number, declared that they could not have gone a mile farther, nor survived another day, but for the succor they received at the station. They were fed and sheltered at this asylum for seven days, when they were furnished with two days' rations, and left for Key West.

The other instance is that of the French brig *Sevre*, which stranded and went to pieces on September 11, in a gale, sixteen miles north of Station No. 1. There were ten persons on board. One was lost. Of the other nine, eight were found on the shore by a colored man named Peter Wright and conducted to Titusville. The remaining man was found by the keeper nearly gone with hunger and thirst, carried to the station, and kept for ten days before he was able to travel.

EIGHTH DISTRICT.

On July 28, the crew of Station No. 9, Marblehead, Lake Erie, rescued two boys, in a rough sea, from the bottom of a capsized boat to which they had been clinging for twenty minutes.

On August 12, the sloop *Belle*, of Oswego, lost her rudder five miles from Big Sandy Creek, Lake Ontario, in a heavy sea. The crew of Station No. 1 pulled out to her in the life-boat, towed her into port by her line, and put her in order. Three men were on board.

On August 14, a small boat containing five men capsized through careless management a mile and a half from Station No. 2, Lake Ontario. The men clung to the boat and in half an hour were taken from the water by the life-boat crew.

The yacht *Silver Cloud*, of Oswego, while engaged in a regatta on September 10, capsized with seven persons on board, a mile from that place. The keeper of Station No. 3 at once mustered a crew, launched the life-boat, and rescued these men, who were clinging to the sides and bottom of the capsized vessel.

A gallant rescue of six men and a woman was effected on the 11th of September from the schooner *E. P. Dorr*, of Oswego, by the crew of Station No. 4, Charlotte, Lake Ontario. The schooner was seen at half past nine in the evening stranded about 1,200 yards from the beach, a mile west of the station, with a torch burning. The night was dark and rainy, and a tremendous sea was rolling in from the northeast. Hurriedly getting the surf-boat upon its carriage, the crew dragged it a mile by hand, abreast of the vessel, and getting it down an embankment twenty feet, launched it and reached the wreck at about eleven

o'clock. The vessel was in a bad position for effort, lying head to, with the heavy sea racing along her sides and tumbling in around her stern. There was no shelter, therefore, for the boat, and a strong current running to the westward made constant maneuvering necessary to maintain the boat in position. To add to the difficulty, there was delay, involving much fatigue to the life-saving crew, owing to the unwillingness of the sailors to leave the vessel, because they thought the woman on board, the cook, could not be lowered into the surf-boat. They were finally persuaded to try it, and the cook was dropped safely into the arms of the surf-boat men. The mate followed, fell partly overboard, and was hauled in. At that moment a heavy sea swept the boat fifty feet astern, breaking the line by which she was held to the schooner, splitting out a piece of the boat at the starboard scull-hole, and lifting the boat almost upright upon its stern, a position favorable to its being tossed end over end. It was with much difficulty that the boat was kept head to the sea, while the gallant keeper changed his oar from the starboard scull-hole to the central or midship stern scull-hole, where he lashed it securely. Meanwhile the vessel had broached to, giving a better lee to the boat for its operations, and enabling the crew to swiftly run up and take off the five men on board. Landing was then effected, though with danger and difficulty from the heavy seas sweeping over the boat. Immediately upon reaching shore the rescued woman fainted away upon the beach, and was carried to a cottage near by and cared for.

The crew of Station No. 7, Fairport, Lake Erie, devoted two hours and a half on September 13, to the rescue, accomplished with the surf-boat, of six persons from the steamer *Pearl*, of Detroit, which stranded at 8.30 a. m., in trying to enter the harbor, a northeast gale prevailing at the time with a very heavy sea, and the weather thick and rainy. The steamer originally had twenty-six persons on board, nineteen of whom jumped from her upon the pier, which she touched when first endeavoring to make the harbor, one being drowned in trying to land in this way. The steamer then fell away and stranded, and the remaining six persons, one of them a woman, were rescued as narrated by the life-saving crew.

On October 9, the schooner *W. W. Grant*, of Port Hope, Ontario, with seven men on board, stranded in a northwest gale and heavy sea, at noon, near the east pier at Oswego, Lake Ontario. The crew of Station No. 3 went out to her relief, and by the use of heavy hawsers got her afloat.

On October 19, the schooner *Julia*, of Kingston, Ontario, with six persons on board, in attempting to make the harbor at Charlotte, Lake Ontario, fell off, dropped and then dragged her anchors, and finally stranded 200 yards from shore, and 500 yards east of the pier. It was then four o'clock in the morning, and a northwest gale was prevailing, with a heavy surf and sea. The keeper of Station No. 4, J. O. Doyle, summoned his crew, hauled the surf-boat up the beach, launched it and brought the six persons on board, one of whom was a woman, safely ashore. The station crew then went to work with anchors and hawsers, and after much exertion, in which they were assisted by a steam-tug, finally succeeded by two o'clock in the afternoon in heaving the vessel off, and brought her safely into port.

The same keeper and crew effected a dangerous and gallant rescue on October 23, from the schooner *Star*, of Millpoint, Ontario, which, after a desperate effort to gain the harbor at Charlotte, during a furious northwest gale, was driven eastward from the pier, at a distance of 1,400 feet from which, and 1,200 feet from the shore, she dropped her anchors in order to ride out the storm. The moment this was done, the sea mounted

her bulwarks and swept her decks on every side, and the crew of seven persons had to take to the cross-trees for safety. This was at six o'clock in the evening. It was dark and the rain fell in torrents. The sea ran so high that it swept the piers and dashed in the windows of the lower light-house, over the top of which it was leaping, and in which, consequently, the lamp could not be lighted. On the beach, where the life-boat crew had assembled, it was rolling in from the northwest in tremendous breakers, while the shifting wind drove the water from the northeast, making a terrific cross-sea. Under these circumstances it was impossible to effect a launch, while the darkness of the night and the violence of the wind made it equally impossible to reach the vessel with a shot-line. As the wind was changing, the only course was to wait for the abatement of the sea. The station beach-light was lit and kept burning to let the crew of the vessel know that their situation was understood. A lantern-squad was dispersed up and down the beach in case any of the men should be washed ashore, and signals were made from the pier to encourage them. Finally, at half past eleven, the sea having somewhat lessened, the hazardous effort was made to reach the vessel. The darkness was so great that she could not be seen, and it was with some difficulty that she was found. Finally the life-boat reached her. Her seven men were nearly exhausted in the cross-trees of the foremast, where they had been for over four hours. At ten minutes past midnight they were landed safely on the beach. The vessel went to pieces.

Good service was rendered on October 30, by Keeper Carroll, of Life-boat Station No. 5, at the wreck of the schooner *F. C. Laighton*, of Bay City, Mich., which stranded in a strong gale at 10 o'clock p. m. on Point Abino, a rocky promontory on the Canadian shore, twelve miles above Buffalo. The surf-boat with a volunteer crew of six men went out to the wreck in tow of a tug, which was one of two that had been engaged to get the vessel off, neither of which was able to get near her on account of the sea. The surf-boat, however, leaving the tug about half a mile to windward, contrived to get alongside of the schooner about half past two o'clock in the morning, though not without great trouble and danger, having broached to once in the heavy surf, and lost three oars. The tugs having left, the surf-boat was hoisted up on the lee side of the vessel to save the boat from being stove to pieces, and the crew stuck by the schooner till morning, when they landed the eight men on board at Point Abino. not without peril, the surf being very heavy and breaking upon the rocky shore.

The schooner *Wacousta*, of Port Hope, Ontario, stranded at 7.30 p. m., on the 7th of November, one and a half miles from the pier at Charlotte, Lake Ontario, and a mile from shore. A northwest gale was prevailing, with a heavy sea and a snow-storm of such density as to obscure the vessel's lights. News of her stranding having arrived through another vessel which came in, Keeper Doyle of Station No. 4 went out to her in the surf-boat, reaching her at eight o'clock, and returning with her crew of six men by nine o'clock. The remainder of the night was spent by the keeper and his men in searching for a vessel erroneously reported to be stranded eight miles to the westward.

On November 8, the schooner *Speedwell*, of Picton, Ontario, with seven men on board, went ashore about 200 yards from the beach, at 5 a. m., four miles west of Oswego. Keeper Blackburn, of Station No. 3, hearing a rumor of the disaster, started up the beach alone, and after a long tramp arrived upon the scene. It was snowing and there was a strong north wind and a heavy sea. A crew was immediately formed under Keeper Blackburn's direction to man the schooner's yawl-boat, which

had come ashore. Meanwhile, the sailors on board sent a line ashore with the water-barrel, by which means a larger line was drawn between the vessel and the shore, and by its aid the seven men were taken off with the yawl under the keeper's direction. The next morning five of the crew returned to their vessel, the storm having moderated. Later, however, it increased to a gale, and the vessel thumped so hard that it seemed likely to go to pieces. The crew being again in danger, Keeper Blackburn mustered his men and hastened to the scene. The line that had been run the day before between the vessel and the land had not been removed, and by its means a 3½-inch hawser was set up. As the crew could not be made to understand where the hawser should be fastened, one of the surfmen, clad in a Merriman life-suit, worked himself out to the vessel, secured the hawser to the mast and superintended sending the five men ashore, one by one, by the breeches-buoy, himself coming from the vessel last.

On November 29, at Oswego, the schooner *Sweet Home*, of Kingston, Ontario, with four men and a woman cook on board, parted the line when in tow, struck the pier and fell away and stranded in a heavy sea 300 feet east of the harbor, where she went to pieces. The four men jumped upon the pier when she first struck, leaving the woman on board. The life-saving crew of Station No. 3 went out in the surf-boat and took the woman off.

NINTH DISTRICT.

The first case of rescue in this district was that of two men, the mate and the chief engineer of the tug *Burnside*, who were capsized at 10.30 a. m., on the 14th of August, in a sail-boat, in Ottawa Bay, half a mile to leeward of the keeper of Station No. 2, who happened to be returning from East Tawas in the station supply boat, and instantly ran down to them in a freshening wind, and took them from the bottom of their boat, to which they were clinging, with the sea breaking over them.

On September 3, the crew of Station No. 3 went out to the relief of the schooner *Vampire*, of Ashtabula, Ohio, which had been struck by a heavy squall, thrown upon her beam-ends, and when she righted had 5½ feet of water in her hold, in which condition she anchored and showed signals of distress. They reached her at 10 o'clock a. m., fell to work at the pumps, and by seven o'clock in the evening got her clear of water, and started her under sail, in good condition, for her destination. Six men composed her crew.

The same crew, on October 3, took off five men from the scow *E. K. Kane*, of Toledo, Ohio, which dragged her anchors and went ashore at five o'clock in the morning in a southeast gale and heavy sea, six rods from the beach, at a point four miles south of the station. When the sea went down the crew helped to unload the vessel and got her afloat and ready for repairing the damages she had received.

Twenty days after, or on October 23, the same vessel broke the castings of her steering-gear so as to become unmanageable, and went ashore at one o'clock in the morning 3½ miles southeast of Station No. 3, and about three-eighths of a mile from the beach, in an easterly gale and heavy sea. The crew of Station No. 3 went out to her in the surf-boat and safely landed her crew of five men within an hour and a half after her discovery. The vessel went to pieces.

On October 27, the steam-propeller *St. Mary*, of Marquette, Mich., stranded in a thick snow-storm, so high upon the beach that her crew of four and her thirty passengers were able to walk ashore. This hap-

pened at 6 p. m., 8½ miles west of Station No. 9, the keeper of which, Capt. Quinton Morgan, having seen her pass at four o'clock in the previous afternoon, and knowing that she had not gone back in the night, gave the patrol instructions to look after her. He found her ashore as stated, but assistance was unnecessary.

TENTH DISTRICT.

The record begins with the rescue, on September 25, of twelve men from the schooner *Erastus Corning*, of Buffalo. The vessel having lost her canvas and some of her spars, anchored in a southeast gale and rough sea at 9 o'clock a. m. four miles southeast of Station No. 12, Two Rivers, Wis., and put up signals of distress. A tug attempted to go to her assistance, but could not get out of the harbor on account of the force of the sea. After two efforts the life-boat crew of Station No. 12 succeeded in reaching her and took off the men on board; after which the keeper procured a tug from Manitowoc to tow her away.

The crew of Station No. 11 rendered considerable assistance on October 1, to the schooner *J. M. Forest*, of Chicago, which had come to anchor in a southeast gale and very high sea near the harbor of Sheboygan, Wis., having run entirely out of provisions and stores, and being unable to show signals at night for want of oil, thus putting her safety to extra risk. The crew lowered a boat and endeavored to make a landing for the purpose of replenishing the vessel, but failed owing to the violence of the sea. In this strait they were observed by the life-boat men of Station No. 11, who went out to them in a tug which is owned by the keeper of the station, Capt. Oley Groh, brought the captain of the schooner ashore, and took him again on board with his stores and supplies, laying by till the gale moderated.

On October 11, the schooner *Alice M. Bears*, of Chicago, stranded at half past four in the morning, in a northwest gale and high sea, fifty yards north of the north pier at Grand Haven. The keeper of Station No. 5 went out to her with his crew in a tug which he owns, and took off the seven men on board. Then, to save her from being broken up, his crew scuttled and sunk her, and when the sea went down pumped her out and hove her off.

The barge *C. O. D.*, of Grand Haven, Mich., with a crew of four, having sprung a leak and become water-logged, received assistance on the same date from this keeper and crew, who took off her deck-load, pumped her out, and towed her into port.

On October 28, the schooner *Presto*, of Grand Haven, Mich., at eight o'clock in the evening, stranded in a southwest gale and heavy sea fifty yards north of the pier at Grand Haven, and the same crew got a line to her, worked her on to the pier, took off her crew of seven men, and scuttled the vessel to save her.

Later in the same night they went to the relief of the schooner *Persia*, of Chicago, stranded half a mile south of the pier, but found that her crew of five men had got ashore.

On October 29, they went out to the schooner *George W. Wescott*, of Kenosha, Wis., which had stranded with seven persons on board, at seven o'clock in the evening, in a southwest gale and heavy sea, not far from the pier, and saved vessel, crew, and cargo by getting the vessel off and towing her into harbor.

On the same evening the schooner *H. B. Moore*, of South Haven, Mich., stranded half a mile from the pier at nine o'clock, in a baffled attempt to make the harbor of Grand Haven, and her crew of eight men

undertook to come ashore in their own boat, the sea being very heavy and the wind blowing hard. The crew of Station No. 5 were on hand, and not having time to use the boat or apparatus, rushed into the surf with lines, and got the imperiled men safely on shore.

On October 31, at 7.30 a. m., the schooner *J. H. Rutter*, of Toledo, Ohio, was seen by the keeper of Station No. 4 (Grand Point au Sable) lying on her beam ends with a signal of distress flying. The heavy surf prevented the surf-boat from getting out to her until the third effort. It was snowing hard and freezing. A few minutes after the boat reached her two tugs came to her assistance, and the life-saving crew staid by until evening, running out lines and carrying messages between her and the tugs. The schooner was finally anchored a mile north of Ludington, and the life-saving crew rowed the captain ashore to procure a gang of laborers to work on the vessel. The next morning (November 1,) the news came that the vessel was going to pieces and that the crew of eight men and the laborers, thirty-six in number, were in danger of being drowned. The life-saving crew went to her assistance with the mortar and lines, fired seven shots, but could not reach her; tried twice to get to her in the surf-boat, which filled each time; were finally towed out to her by the tug *Col. Graham*, took off eight men, whom they safely brought ashore, although their boat was filled again. On the next trip the boat was swamped and driven ashore. On the succeeding trial the crew reached the wreck, and ran lines from her to the shore, in order to bring in the men with the breeches buoy, when the tug contrived to run up alongside and took them all off. The surf-boat suffered considerably in these labors, six holes being made in the bottom, and the boat otherwise damaged.

The crew of Station No. 5, on November 1, rendered extraordinary service, giving aid and succor to no less than five wrecks in one day. At eleven o'clock in the morning, the district superintendent at Grand Haven received a telegram stating that the bark *L. C. Woodruff*, of Cleveland, Ohio, was ashore at White Lake Harbor, 42 miles distant, sunk in 13 feet of water, with the crew all in the rigging. Keeper Connell, of Station No. 5, started at 12 o'clock m. by special train to the rescue, with the life-car and apparatus and four of his men, the other four remaining for service at Grand Haven, and arrived abreast of the wreck in two hours, having to change cars once, and transfer the crew and apparatus again from the cars to a tug-boat, which carried him six miles farther by inland water to the scene of the wreck. The vessel lay 150 yards from the shore with the sea making a clean breach over her, two of her masts gone, her crew of ten men in the fore-rigging, and hundreds of excited spectators looking on. As this disaster involved loss of life, it was made the subject of investigation in accordance with the uniform practice of the service, the result of which will be given hereafter. It is sufficient here to record that, although three of the crew of the *Woodruff* were unfortunately lost, the other seven were saved through the instrumentality of Keeper Connell and his men.

During the preparations for the departure of part of the crew for this wreck, the schooner *Australia*, of Muskegon, Mich., in attempting to make an entrance between the piers, which is about 400 feet wide, was swept aside by the heavy sea and strong current, and struck the end of the north pier, staving in her starboard bow. One man jumped from her upon the pier, and another, in attempting to do so, was carried overboard by the heavy seas that now swept her decks and was lost. The vessel continued to thump the pier, but finally worked alongside and grounded, when the life-saving men threw their heaving stick and line

to her, and getting her lines made them fast, thus preventing her from swinging broadside to the beach and becoming a total wreck. The remainder of her crew, six in number, were then taken off and brought to the station.

The remnant of the volunteer life-saving crew was now in charge of surfman John De Young, the keeper having gone with the others to the *L. C. Woodruff.* Anticipating disaster from the heavy weather, surfman De Young had the surf-boat hauled down to the beach. Soon after, about twelve o'clock, the schooner *America*, of Chicago, went ashore north of the piers, and he and his men launched the life-boat, and after a hard pull reached the vessel, and brought her crew of eight men safely ashore.

At three o'clock the schooner *Elvina*, of Oswego, N. Y., came ashore between the north pier and the *America*, her stern swinging against the latter's bow. The life-boat crew waded out into the breakers as far as they could, and succeeded in getting a line from her, which they made fast to the pier, thereby preventing the vessel from beating against the other schooner. They went out in the surf-boat and brought the captain ashore at his request.

Shortly afterward, the schooner *Montpelier*, of Detroit, in attempting to run into harbor, struck the outer bar, fell off to leeward, and grounded on the wreck of the steamer *Orion*, knocking a hole in her bottom and filling immediately. The seas at once swept over her, and her men took to the rigging. The life-saving crew immediately launched the surf-boat, and with great toil and difficulty succeeded in reaching the vessel, from which they rescued seven men and a woman.

The exploits of the life-saving crew at Grand Haven in effecting these rescues in the heavy sea that was that day running, were the theme of general commendation in that region.

On November 5, the crew of Station No. 12 (Two Rivers, Wis.), went out in a heavy sea at three o'clock in the morning to the relief of a schooner without name, belonging at Manitowoc, Wis., which had stranded about one mile north of the station. The sea was so heavy that the wrecking-tug stationed at that place was unable to get out to her assistance, and the surf-boat could not help the vessel to get into port, but rescued the three men on board, being filled in the effort, and compelled, by having to keep the head of the boat to the sea, to land one mile north of the harbor.

The steamer *St. Albans*, of Cleveland, Ohio, with 25 persons on board, stranded, on the rocks at three o'clock in the morning of November 10, in thick and foggy weather and a rough sea, nine miles from Milwaukee. The crew of Station No. 10 went immediately to her assistance with the surf-boat, which involved a long pull through a heavy northeast swell, and, in conjunction with three tugs, got the vessel off, which was thereby saved from destruction.

REPORT OF CAPTAIN J. H. MERRYMAN

UPON THE

WRECK OF THE STEAMER METROPOLIS.

REPORT OF CAPTAIN J. H. MERRYMAN, INSPECTOR OF LIFE-SAVING STATIONS, UPON THE WRECK OF THE STEAMER METROPOLIS.

UNITED STATES LIFE-SAVING SERVICE,
February 9, 1878.

SIR: Immediately upon the receipt of your instructions of the 1st instant (S. I. K.), I started for the scene of the disaster to the steamship Metropolis, on Currituck Beach, and, arriving there on the morning of the 3d instant, proceeded at once to make the required investigation of the circumstances attending the said disaster, and, continuing the inquiry until the morning of the 5th instant, I have the honor to submit the following report:

The last of the survivors having left the beach for Norfolk on the 2d instant, I was unable to obtain authentic information as to occurrences on board the Metropolis previous to her discovery by persons on shore, and was therefore confined to information and testimony obtained from the crew of life-saving Station No. 4, and other persons in the vicinity who were present and engaged in rescuing and caring for the survivors. From the testimony the following facts appear:

The wreck was first discovered about 8 a. m., January 31, by N. E. K. Jones and James E. Capps, who happened to be on the beach. A fog enveloped the coast at the time, through which they caught a glimpse of a mast, but could form no idea of the character of the vessel until they got opposite her, when they saw but one mast standing and that there were many people on board. Jones at once dispatched Capps to notify S. C. Brock, the nearest neighbor, about half a mile back on the Sound shore, get his horse, and ride to Station No. 4 with the news. Soon after Capps left, Jones discovered several persons struggling in the water near by, and one or two further up the beach among the *débris* of the wreck, already breaking up, although stranded but little more than an hour. Jones at once engaged in hauling persons out of the surf, and had thus brought out six or eight when Mr. Brock rode by on his way to the station, about 4½ miles northward. Capps had notified him, and getting back to the beach at about half-past nine, found the vessel much torn up, the sea breaking all over her, one mast standing "with sail set on it." It is quite impossible to determine with accuracy the time of day of the various occurrences, as on such occasions great excitement prevails and pocket time-pieces are rarely carried by the fishermen, while the clocks in the dwellings are seldom correct. Perhaps the only accurate time-piece on Currituck is at the light-house, and the keeper, Mr. Burris, testifies that he was informed of the wreck about 10 a. m., by a messenger from the Light-House Club, "nearly half a mile below," at which some of the survivors had arrived, and he believes before the life-saving station was notified. He started for the wreck with his two assistant light-keepers, and on his way was overtaken by the crew of the station with the mortar apparatus. This corroborates the statement of Keeper Chappel that he received intelligence of the wreck about 10 a. m., although Mr. Brock thought it about 8.30 when he reached the station, while the master of the Metropolis reported

that Brock did not make his appearance on the beach until 11 a. m. It seems to be generally conceded, however, that the mortar apparatus was on the ground about noon.

The keeper was out on the beach at the moment of Brock's arrival, but soon returned and found his crew preparing for the work before them. Brock states he (the keeper) "asked me if I thought he could get his boat down there in time; I told him I did not, the distance being great, and the vessel fast breaking up. He then put the mortar apparatus in the hand-cart, and taking the medicine-chest, he and I started for the wreck, leaving the crew to follow with the apparatus."

In order to appreciate the difficulty which the six men encountered in hauling the mortar-cart and load, it must be remembered that station 4 is situated on a portion of the coast so flat for nearly a mile inland, and so slightly above ordinary high water, that the storm-tides sweep over it, and, surrounding the station, cover the sandy plain to a depth of several inches, and this had occurred the night before, making the sand so soft and yielding that the wheels of the cart, with their broad tires, five inches wide, cut four or five inches below the surface, while the feet of the men, as they labored with their load, sank in the sand at every step; consequently, the party could make but slow progress. The cart contained the mortar, three balls, the whip-line and block, the breeches-buoy, a tackle, powder-flask, quick-matches, match-rope, and line-stock, line-box, and a Merriman life-saving suit, which, with the cart, made a dead weight of more than 1,000 pounds—166 pounds to each man. (Standard authorities give the draught of man at 150 pounds over a firm, level road, and say that a porter can transport, in a wheelbarrow, 150 pounds 10 miles a day.) These men were not fresh, as within the preceding twenty-four hours one of them had walked 32 miles through the storm on the north patrol, another 24 miles on the south, while two others had walked 16 miles each, and the remaining two 12 miles each. Frequent halts were therefore imperative. The wonder is that they got the apparatus to the wreck so soon as they did. It could not have been done had they not been overtaken about a mile and a half from the station by Mr. John J. Dunton with his horse and cart. He states: "They (the crew) were worn down, it being a bad beach for men to travel, and asked me for assistance. I hitched on to the cart and was glad to do so. We arrived at the wreck about 12 o'clock."

The mortar was immediately got into operation. The statements vary somewhat as to the number and order of the shots fired, which is not remarkable, as on such occasions exciting events so quickly follow each other that comparatively cool and collected men fail to recall them in their exact sequence.

The testimony of the crew of the life-saving station as to the order of the firings is probably the most reliable, as it is concurrent, and the apparatus was under their management. The first shot was at high elevation, the distance to the wreck being overestimated. The ball, well aimed to windward, fell far beyond the wreck, while the line was bowed upward high above the fore-truck of the only spar left standing, and, swayed by the wind, fell clear of the spars of the foremast and across that portion where the mainmast had stood, and to the leeward of the wreck, into the sea, the wind being from the southward. The steamer was lying nearly head on to the mortar party, and, her extreme beam being 34 feet, she presented a comparatively small object, at the distance of 100 yards, over which to cast a line. However familiar or skillful the station men may be in the use of the mortar, the failure of the first shot is not unusual, as the distance to be reached and the force of the

wind are difficult to estimate. The result of the first shot in this instance enabled better success in the second attempt, for the line was then lodged on the port foretop-sail yard-arm. A man, said to be the second mate, was seen to go aloft, and laying out on the yard (the top-sail was still set and aback) got the shot-line from the yard-arm and carried it into the slings of the yard, when he hauled in the slack from shoreward and dropped it to the deck, where it was seized by persons standing on the starboard side of the hurricane deck, their only remaining foot-hold, as the after part of the vessel, together with a great portion of the port side, was already gone, while the extreme forward part of the vessel was seen to be moving independently of the remaining portion. The whip-line was at once made fast to the shot-line by the life-saving men and was hauled toward the ship.

It was now observed from the beach that the shot-line lay across the jib-stay; that is, leading outside the stay around its port side and at a sharp angle aft, to the starboard side of the wreck. The angle became more acute as the whip progressed toward the ship on account of the strong current or "set" running northward. The strain upon the shot-line increased with every inch of the whip-line exposed to the action of the current, and all this time was actually sawing across the iron-wire rope of which the stay was made. The whip had progressed more than half-way to the vessel and the block had lifted clear of the sea when the damaging chafe of the line as it was hastily hauled across the sharp incline of the iron-wire stay, together with the strain caused by the strong current, caused the shot-line to part.

A citizen, John J. Dunton, testifies that at this juncture the whip had "fouled with something under water," and it is possible that some circumstance of this nature assisted in producing the accident. Had the shot-line been dropped to starboard of the stay by the man aloft, as it should have been, and the handling of it on board been intelligently directed, the result would have been different. This is the first instance in the history of the service that a shot-line has parted after reaching a wreck. The line used was a new one, of Italian hemp, braided after the style of the patent sash-cord of the Silver Lake Company. It is always free from turns, however coiled, and very rarely kinks when flying from its faking-box. No shot-line ever used is superior to it. The line was at once French-faked on the beach for another attempt, which was for some time delayed by the strange and inexcusable neglect of the keeper in having but two charges of powder in his flask. The station, where plenty of powder is stored, was four and a half miles away, and recourse was had to Mr. Brock, and a supply of powder was brought from his house with all possible haste. By this means a third shot was fired, the line parting at the ball, which went far to seaward. But one ball remained, the first shot having been hauled ashore, with which the fourth shot was fired with like result. A statement having been published that the line parted in consequence of a spiral wire or other appliance for connecting the line with the shot not having been used, it is proper to remark that after many experiments these methods have been abandoned, and the best results are obtained by attaching the line, after wetting it for a few feet at the end, directly to the projectile. The line rarely breaks when connection is made in this way, but more frequently does so when the devices referred to are employed. In this instance the line having gone safely at the first two shots, I can only account for the failure of the other two by supposing that the powder obtained from Mr. Brock was of a stronger and quicker nature than the slower-burning powder provided for the mortars, and the initial velocity of the ball thus

became greater than the line could bear with its increased weight, water-soaked and partially clogged with sand as it was after the second shot.

The only hope of the life-saving men now remained in the possibility of procuring more balls and powder and a dry line from the station. Horses were unavailable and two men were sent on foot. They obtained a horse to hasten their return, but arrived only when the tragedy was ended. In the mean time, Keeper Chappel put on the Merriman life-saving dress and attempted to reach the wreck with a line, but, greatly fatigued by his march and labor, he was unable to stem the strong current and force his way beyond the breakers, and after two praiseworthy efforts was compelled to abandon the endeavor exhausted. Will it be believed that a man provided with a similar dress stood on the deck of the Metropolis in this trying time, yet made no offer to bring a line ashore, which, properly habited in the dress, with a stout heart and bold effort, he might have done with comparative facility on the incoming seas?

When the hapless people remaining on the wreck realized that no further effort could be made for their rescue from the fast-crumbling remains of the doomed Metropolis, they accepted their last alternative, and singly and sometimes in groups plunged overboard, trusting their lives to the treacherous waves. The surf by this time was running high, and the waters were laden with floating fragments of the wreck, amid which, sorely and in some cases fatally injured, drifting northward and driven by the rolling breakers shoreward, came the struggling, drowning people, to be received in the welcome arms of their rescuers, who, with precarious foot-hold, strove in their work waist-deep in the inner breakers and undertow. Prominent among these brave and humane men were Keeper Chappel and his surfmen, Samuel A. Gillett and Piggott Gillikin, together with S. C. Brock, J. J. Dunton, William Jones, N. E. K. Jones, T. J. Poyner, Captain Everton, and John Saunders, and others resident in that vicinity. Even a noble Newfoundland dog, owned by Mr. Brock, incited by the example before him, joined in the work, and plunging into the surf safely brought to shore a half-drowned man. In a word, all present were engaged either in hauling the people out of the surf or receiving them from others and assisting them to the fires kept burning near the sand-hills.

The labors of the rescuers in the surf were unceasing, but their greatest exertions were required when the vessel finally broke up, toward sunset, and the surf was thick with people and fragments. The rescuers, without exception, were battered and bruised by the wreckage while extricating the drowning people from the masses of floating rubbish.

The scene may be better imagined than described. It was one of terror and wild confusion, of struggling heroes and perishing victims in the greedy seas, while the air was filled with encouraging shouts and despairing shrieks. In the midst of this last scene, a man, who afterward proved to be Captain Ankers, was seen struggling in the surf, clad in a rubber-swimming or life-saving suit. He was helplessly tossed about in the sea, utterly unable to help himself. Observing this, Keeper Chappel went further into the breakers, followed by Surfman Piggott Gillikin and Mr. Brock, and seizing the captain brought him, aided by his companions, safely ashore, much exhausted, and with his rubber dress, from some unexplained cause, nearly filled with water. He was taken to Mr. Brock's house, where he remained kindly cared for until the next morning.

No account was taken of the number thus rescued, but it was thought to be more than a hundred. The medicine-chest was of incalculable

service, and several persons were restored from apparent death. The survivors were distributed among the neighboring dwellings, the life-saving stations being too far away to be reached in their exhausted condition. The citizens fed and clothed them to the full extent of their means, and their generous hospitality is worthy of all praise. In this regard the light-house keeper, Mr. Burris, and Messrs. J. J. Dunton, S. C. Brock, Josephus Baum, and T. J. Poyner, deserve particular notice.

It will be seen from the foregoing that the crew of Station 4 do not deserve the censure which has been applied to them. Regarding their conduct I found but one sentiment among the people of that neighborhood, as to their faithful and unremitting efforts to rescue the passengers and crew of the Metropolis. The evidence of all the witnesses is to this effect, but I quote from the testimony of the Signal-Service observer, William Davis, whose position afforded probably the best opportunity for hearing a free expression of opinion immediately after the event. He states:

> As near as I can find out the life-saving men did all that human beings could do in trying to save life and care for the living. They ran great risk in hauling people out of the surf, the fragments of the wreck striking them with great force in the rough sea. I was informed by the citizens who were at the wreck that the life-saving men worked faithfully. I was also informed by the life-saving men that the citizens all worked faithfully in saving lives, carrying those saved to their own dwellings, and furnishing clothing for the naked. * * * * The life-saving men deserve much honor and praise for their bravery in risking their own lives to save those about to perish. I will say that there were only two men who spoke against the Life-Saving Service: one was the captain, and another who had charge of the passengers.

Much unfavorable comment has been made on the fact that the wreck was not discovered by the patrol. Under the circumstances this was impossible. Perry, who had the south patrol from midnight until sunrise that morning, returned to the station at 7 o'clock, and probably passed the place where the wreck occurred about 5 o'clock a. m. If Rogers, the next patrolman south, had left the station immediately upon the return of Perry, and traveled at the rate of three miles per hour, no small task through the soft sand, for it was then nearly high water, according to the Coast Survey Tide Tables (6 a. m. for Oregon Inlet; difference at Currituck small), he would have seen the wreck about 8.30 a. m., or about the time she was discovered by Capps and Jones. He could not possibly have carried the news to the station as quickly as it was done by Mr. Brock on horseback, so that really no time would have been gained. When Perry passed the place where the ship afterward struck it was not yet daylight, and the weather was thick and foggy; otherwise, he might have seen the vessel's lights approaching land. If the Metropolis had carried, as I am informed she did not, a small gun or swivel for making sound-signals of distress, and it had been fired two or three times when she struck or as she neared the land, its reports would have been heard at the light-house, and also at the station as the wind was, and there would have been time for the life-saving crew to have reached the wreck before the hour they were notified by Mr. Brock.

The necessity for additional stations on this coast is apparent from the extent of the patrol alone, and when the terrible nature of the coast and its liability to frequent shipwreck are considered, appears extreme. The stations should not average more than four or five miles apart, and even with these there are portions of the coast which it would be perhaps impossible to protect against disastrous results to life, in case of shipwreck upon them. There are such places notably between numbers 2 and 3 where heavy gales from the eastward drive the sea across the low, flat shore, into the Sound, and strong westerly gales, following long-continued southerly winds, force the waters of the Sound across the

same flat shores to the ocean. The water then on the flat would prevent the approach and use of the mortar apparatus at a wreck, and would be too shoal for the passage of boats. These points are of varied extent, being in places from one-fourth by one-half mile north and south by three-fourths of a mile east and west, and in one place three miles north and south. Wrecks occurring at these places during great easterly gales must be beyond human aid from the shore until the waters recede.

The increased number of stations, with some experience to the surfmen, would make the sixth district quite as efficient as the third and fourth districts, where it is noteworthy that in the same storms which wrecked the Huron and the Metropolis in the sixth district, the crews of two vessels were rescued on each occasion by the crews of the stations.

I carefully inspected Station 4, and found it fully equipped with every appliance adapted to the nature of the coast, and the apparatus in perfect condition. The surf-boat is in fine order and admirably adapted for service on the coast. The weight is about 750 pounds, and a heavier or self-bailing and self-righting life-boat cannot be used anywhere along the coast, except perhaps from Oregon or Hatteras Inlet.

The men appear to be familiar with the drill and exercise with boat and apparatus, but the Life-Saving Service having been but recently introduced in this district, they need more experience in actual service at wrecks with the boats, as they are unaccustomed to going off against a very heavy surf. Their experience as surfmen has been gained principally as fishermen going to sea in comparatively moderate weather, in boats which, compared with those supplied the stations, are clumsy and frail affairs. Further experience with the life-saving boats and apparatus will also enable them to command such respect from the people who always assemble at a wreck as to deter the latter from volunteering advice and suggestions to the life-saving men, at present a great obstacle to orderly and methodical operations on this coast, and instead induce them to lend their assistance under the direction of the keeper, whose superior experience and judgment will then be recognized.

The proposed additional stations, with an increase of two surfmen to each, will, in my opinion, amply provide for the needs of the coast, and make the service there as efficient in its operations as in the older districts on Long Island and New Jersey, by reducing the length of the patrols, enabling earlier discovery of wrecks, prompter arrival of boats and apparatus at the same, and the early assemblage of the crews of adjacent stations when signaled for aid. The two additional men will materially relieve the labors of the patrol, besides affording an extra man to care for the station while the crew is engaged at a wreck, and another to remain on the beach to aid the boat in landing, and for other useful duties.

As upon other portions of the coast of the United States, it is difficult to obtain competent men for keepers at the present rates of compensation. It should be sufficiently increased to secure the best men for these positions, and they should be required to reside at the stations the year round.

I examined the fragments of the wreck which littered the beach for two miles above the spot where the steam-chimneys of the boilers alone indicate the place the vessel struck. The fragments are unusually small, and her rottenness so apparent that there was but one opinion as to her unseaworthiness among the many persons I met on the ground. I submit herewith two pieces of decayed wood from different parts of the vessel's frame, fair samples of a large portion of the timbers.

I submit herewith the sworn statements of the keeper and crew of Station No. 4, together with the affidavits of John J. Dunton, N. E. K.

Jones, S. C. Brock, and James E. Capps, who reside in the immediate vicinity of the wreck; also the sworn statements of N. G. Burris, keeper of Currituck light-house, and of William Davis, Signal-Service observer, then at Station 4. These were the only prominent persons who appeared to be familiar with the circumstances attending the discovery of the wreck and the subsequent events.

I also submit a brief documentary history of the Metropolis, formerly the Stars and Stripes.

Very respectfully, your obedient servant,

J. H. MERRYMAN,
Captain United States Revenue Marine, Inspector.

Hon. JOHN SHERMAN,
Secretary of the Treasury.

JOHN G. CHAPPELL.

Keeper of Station No. 4, Jones Hill, North Carolina; aged 42 years; home 15 miles from station. Have belonged to service since December, 1875, and keeper since March, 1876; succeeded Captain Gale. Occupation, fishing and farming; former in fall, winter, and spring, mostly in the Sound, sometimes off shore. Was at station on Thursday, 31st January.

First heard of wreck of the Metropolis about 10 a. m. that day, from Swepson C. Brock, who met the patrol, John Rogers, and came with him to station. Brock was mounted. He said there was a wreck ashore opposite his house, that she was going to pieces as fast as she could; that men were washing off and coming ashore; said no assistance could be rendered except to drag the people out of the water; also to hurry there. Went to work loading the hand-cart with mortar, three shot, whipline (large one), breeches-buoy, large tackle, heaving-stick with line, flask of powder, quick-matches, match-rope, and the new shot-line, braided large, and "Merriman dress"; occupied about ten minutes; took medicine-chest, and started with Brock, the hand-cart following, hauled by six men; the distance to wreck about four miles and a half.

With Brock reached wreck about 11.30. Hand cart arrived about 12 or 12.30. Did not notice the hour; do not carry a time-piece. Before reaching wreck saw four or five bodies on the beach, one a female, Mrs. Harris; did not see the wreck until within half a mile of it; weather was thick; tide about half ebb. The sea had been over the flat near the station that morning. Thought it was a total wreck after seeing the bodies. The wreck was heading on shore, foremast standing, main and mizzen gone; stern and part of port side gone; wreck careened to port; people in starboard side; some in fore-rigging. She was about a hundred yards from the beach.

When hand-cart arrived prepared to throw a line. Placed and loaded the mortar. Thomas Evington, a by-stander, assistant light-keeper, offered to assist, and in attempting to arrange the line-box, moved the frame, and when it was put back in the box the line somehow was fouled. I arranged it afterward.

The first shot carried the line too high and the wind (S. E.) blew it clear over the wreck; otherwise the line would have fallen on the wreck. Hauled in the shot-line assisted by the three light-keepers; faked it while the mortar was loaded again. Depressed the gun (mortar) and the second shot lodged the line on the port yard-arm—fore-topsail yard. The people soon got the line; the whip-line was bent to the shot-line, and the people began hauling; the current was strong to the northward. The shot-line was hauled on board across the fore-stay, which was of

wire; those hauling stood on the starboard side, and the bight of the line trending to the northward the strain was great. The block of the whip got about half way to the wreck when the shot-line parted, having been chafed in two by hauling across the fore-stay, the nip being very short; hauled the whip ashore. The shot-line that came back with the whip was 158 yards long (measured since); a great deal of the shot-line had been hauled on board before they could get a steady pull on it.

Faked the shot-line as quickly as possible, and fired again, but the shot-line parted at the shot. Another shot was fired, line parting as before. Had hauled one ball in—the first one fired. Had expended all the powder in the flask. Sent to the station for another line, three shot, and the powder-tank. Tried, in vain, to get horses. The men got one and a cart near the station. When they arrived at the wreck, with the lines, &c., it was too late.

Then put on the rubber suit and made two attempts to reach the wreck; but could not get beyond the breakers. Have practiced in it before. The sea was very rough; could not get through it in the Merriman dress. The wreck was breaking up all the while, and after the failure to reach them in the Merriman suit, the people began to jump overboard. As they came in with the breakers the station-men and several persons went in after them and brought them ashore. Don't know how many were thus saved; perhaps a hundred.

Every one who came inside the breakers was saved, except a few who died from exhaustion after getting them ashore. The station-men, and some others, went into the surf after the people, and bringing them out they were taken by the by-standers to the fires, of which several had been built and were kept burning on the beach.

Saw Captain Ankers coming in, with a rubber suit (Merriman's); appeared helpless. Went in with Mr. Brock, up to the waist, to assist the captain, and brought him ashore. His rubber suit was full of water. Could not have reached the shore without assistance. Five of the station-men, including keeper, were badly bruised with wreckage striking them while in the surf. Were about three hours thus rescuing the people; every one got thoroughly wet. The weather was not very cold. All might have been saved if the station had known of the wreck earlier; or if a team had been at hand, could have saved all who were on the wreck when it was first reached.

William Perry had the south patrol that morning; left the station at 12 midnight, and returned about 7 a. m. The beat can be covered in five hours, at a steady pace. In bad weather, against a gale up or down the beat, it will take longer, and high water makes harder walking. The patrol is ordered to remain out from midnight to sunrise. The beat is six miles south, about eight miles north. If the boat had been there when the wreck was first reached, it could have gone off safely to the ship. An hour later it could not, as the sea grew higher.

JOHN G. CHAPPELL.

Sworn and subscribed to before me this 4th day of February, 1878.

J. H. MERRYMAN,
Captain United States Revenue Marine, Inspector.

WILLIAM PERRY.

Surfman; fisherman (blue-fish). Age 24. Reside at Kittyhawk Banks. Have served since 5th March, 1876. Was on south patrol on the morning of 31st January. Went to the end of the beat. Was there about 3 a. m. or 3.30 a. m. Weather thick and rainy. The water was running over the beach, and it was bad traveling; had to rest occasionally. Saw

no vessels nor lights. Did not meet patrol from station 5. Have met him; met him the night before. Returned to station at 7 a. m. It was still thick and rainy. Afterward, assisted the men with the hand-cart, and ran into the sea after the people several times. Have heard Keeper Chappell's statement read, and believe it to be true as far as I know. Was not there when the keeper helped the captain ashore.

WILLIAM PERRY.

Sworn and subscribed to before me this 4th day of February, 1878.

J. H. MERRYMAN,
Captain United States Revenue Marine Inspector.

PIGGOTT GILLIKIN.

Surfman; seaman for thirty years, from cook to master. Fifty years of age. Have been at station since December last. Was on patrol first part of night January 30, north; came in at 12. Assisted in hauling hand-cart to wreck of Metropolis. Left station about 10 o'clock. Hauling was bad; sand was wet and heavy; could not have hauled it with six men. A Mr. Dunton overtook us about one and a half miles from station, in horse-cart; got him to help. All were much exhausted. Don't know what time the wreck was reached. The mortar was fired as described by the keeper. The line was cut by the fore-stay; could not see how many were hauling on it. Saw a man get the line from the port fore-topsail yard-arm. He was no seaman, for he went out and laid in astride the yard. The line was not dipped under the stays; was hauled across the port side of the stay by men standing on starboard side of hurricane-deck; a very strong current running north two and a half miles per hour. The tally-board went off with the whip-line. The line was badly managed by those on board the wreck. Saw the captain coming on shore in the Merriman dress, sometimes head up, then feet up; on his face, and sometimes on his back. Saw keeper go in to help him; followed the keeper, also Mr. Brock. Keeper caught him first, then I got his right hand, and Mr. Brock got hold of his right shoulder. The captain appeared to be perfectly exhausted. Kept no account of the people we helped; had no time; all worked as hard at it as possible. Had been there in time could have saved every soul. As it was, the station-men and citizens saved nearly all who came inside the breakers after they got there, or until it was all over.

PIGGOTT GILLIKIN.

Sworn and subscribed to before me this 4th day of February, 1878.

J. H. MERRYMAN,
Captain United States Revenue Marine, Inspector.

The undersigned, surfmen of Station No. 4, sixth district, have heard the foregoing read, and hereby testify to its truth to the best of our knowledge and belief.

his
JOHN + ROGERS.
mark.

his
JAMES + S. ROGERS.
mark.

SAMUEL A. GILLETT.
NAT. GRAY.

Sworn and subscribed to before me this 4th day of February, 1878.

J. H. MERRYMAN,
Captain United States Revenue Marine, Inspector.

WILLIAM DAVIS.

Received news of the wrecked Metropolis by messenger on horseback, at 7.15 p. m., on Thursday, 31st of January, 1878. I took instrument, paper, signal-flag, and necessary tools for opening telegraph-station as soon as possible upon arriving at scene of wreck. I started at 7.30, and traveled on horseback 15 miles, leaving my horse and going on foot remainder of trip, which was 4 miles. The reason I went on foot was that the horse was very tired, and I not being used to horseback riding, thought I could travel faster on foot. Arrived at scene of wreck at 3.20 a. m. on Friday morning, cutting the wire and opening communication at 7.30. Upon arriving at scene found two life-saving men taking care of the living, and doing all that was in their power to keep up a fire, and keep those comfortable that were living, by medical aid, &c. At daylight I went up the beach and witnessed the scene, and as near as I can find out the life-saving men did all that human beings could do in their operations in trying to save life, and to care for the living, and burying the dead.

The life-saving men ran great risks of their lives, in trying to haul those out of the surf, by fragments of the wrecked steamer striking them with great force by the rough sea. I was informed by the citizens that were at the wreck that the life-saving men had worked faithfully in rescuing those who were struggling in the water, and caring for those who were safe on land, and burying the dead. I was also informed by the life-saving men that the citizens had all worked faithfully in saving the lives and carrying them to their dwelling-houses and furnishing clothing for the naked. In closing I will say that the Life-Saving Service deserves much honor and praise in being so brave in running the risk of their own lives to save the lives of those who were about to perish. I will say that there were only two men who spoke against the Life-Saving Service; one was the captain, and one who had charge of the passengers, and I think the latter said more than he ought to have said; in fact both spoke very hard of the service, not knowing what the duty of the service were required to do.

WILLIAM DAVIS.

Sworn and subscribed to before me this 4th day of February, 1878.

J. H. MERRYMAN,
Inspector.

N. E. K. JONES, of Currituck Beach, North Carolina, being duly sworn, deposes and says:

After a blow, I generally make it a custom to go out on the beach to see if any vessel or stranded property has come ashore. I, in company with James E. Capps, went out on the beach Thursday morning between 8 and 9 o'clock. While on our way we saw the mast of a vessel. Capps said, "Mr. Jones, yonder is a vessel ashore." I noticed it, and we hurried down as fast as we could. It was quite foggy, and at times the vessel was obscured by the mist, which caused us several different times to think she had gone to pieces. When we got near the vessel, we couldn't distinguish whether there was any one aboard or not. When we arrived abreast of her, we discovered men, and they cheered us. Knowing I had no team to go to the station, I hardly knew what to do. I told Capps to go up to Mr. Brock's (the nearest neighbor) and get his horse and go to Station 4 and notify them of the wreck. Capps started off on a run, and soon after he left I discovered that a man had jumped overboard, and in watching for him saw several others

in the water. I also saw one or two men further up the beach to the northward among the *débris*, whom I afterward found to be some who had got ashore in one of the ship's boats. The vessel was lying with head west-southwest, and about 150 yards from the beach. She careened a little to the southward, and there was a heavy surf on. She had one of her square sails set, one mast standing, smoke-stack gone.

I ran down to the surf, and as a man came in, I pulled him out, and placed him out of reach of the water. I then pulled out another. All had on life-preservers. After I had pulled out about six or eight, Mr. Brock came down on his horse on his way to the station for help. I ran up and asked him if he had any matches, as the men were nearly frozen, and I wanted to build them a fire. He had none and went off on a run toward the station with his horse. I continued pulling men out as fast as I could. It was with difficulty that I could free myself from one of the men I pulled out; he held on to me after I got him out of the water, but I had to leave him and attend to others. A little further up the beach saw a man on his knees by a telegraph-pole. One of the survivors and myself raised him up, he having been bruised by the drift-stuff, as we afterward learned. A number of the survivors asked me to take him to my house, which I did, several others accompanying me.

While on my way home, Mr. Brock overtook me, as he returned from the station, and said Captain Chappell and crew were coming right down with the apparatus. I came home with the men, and left them in care of my wife, and returned to the beach to look out for others. When I returned the life-saving crew were there, together with the keepers of Currituck light-house; also John Dunton, Bill Jones, Mr. Brock, and others. The life-saving crew were getting things in readiness for action. The mortar was fired, and at first shot the ball was thrown over the end of one of the spars (don't know the name of it). The crew of the vessel cheered and we returned it. Soon we saw one of the crew of the vessel going out on the spar after the line. He seemed to have great difficulty in getting it and getting back to the mast. The ship's crew then pulled on the line. Some on the beach said we ought to go up the beach with one part of the whip, and others said we ought to go down with it, as the current was running strong to the northward. We walked down the beach to the southward against the current for some distance. There seemed to be a great deal of strain on the rope (whip). The people on board succeeded in raising the block clear of the water, when the shot-line parted, and that end of the whip went adrift.

We hauled it ashore as quick as we could, while the life-saving crew got ready for another shot. The mortar was fired again, and the line parted near the ball without taking out any of the line. They then got ready for another shot, but found they had no powder. Mr. Brock furnished some, and, I think, they fired again, but can't remember what the result was.

Some one asked whether the vessel's life-boat (which had come ashore in the morning) couldn't be used to take the people off. Some said it was too rough to make the attempt. The crew of the vessel then seemed to get impatient and began to jump over again. By this time—twelve or one o'clock—a crowd began to accumulate on the beach, some coming from the mainland. Some one asked in my presence why the life-saving crew didn't go after what they wanted to render further assistance with the apparatus. I suppose they meant the surf-boat. Then the life-saving crew, with the rest of us, dropped the apparatus and went to work to save the people as they washed up. I think we saved in all at least one hundred.

The tide then began to make and the vessel began to break up pretty fast, and about an hour before sunset the mast fell and the sail with it. Directly after this I saw fifty or sixty men clustered together on the northward gunwale. Just after the mast fell I looked toward the wreck and found the vessel was entirely gone and the people with it. I remained, with others, on the beach until all that could be saved were saved. The greater number saved had on cork jackets, as had also those who perished.

It was found that quite a number of the bodies were badly bruised, caused probably by coming in contact with pieces of wreck. The vessel was evidently an old one, as shown by the small and rotten pieces that came ashore.

There being no more lives to save I went on up the beach to look out for wrecked stuff, the fragments of which were strewn up the beach as far as Whale's Head, about two miles. I returned home, arriving about dark. Found the gentleman, Captain Harrison, whom I had left at my house that morning, much better. He made some inquiries in regard to his wife, whom he supposed was drowned. I told him there was one lady saved and two missing. He asked me to describe them, and I did so. He said the drowned one was his wife, and requested me to go down with him after supper to the body, which I did. It proved to be his wife. He returned home with me and remained all night. While we were on the beach he noticed one of his trunks—also those of Mrs. Myers—had been broken open. Captain Harrison told me that his trunks had been broken open by some of the ship's company, as he had seen one of them wearing a suit of his own clothes.

This is all I know of the wreck of the steamer Metropolis.

N. E. K. JONES.

Personally appeared before me and testified to the aforegoing this 4th of February, 1878.

WALTER WALTON,
Assistant Inspector and Acting Superintendent.

S. C. Brock, of Hobbs Woods, and residing on the Sound shore, Currituck Beach, North Carolina, being duly sworn, deposes and says:

At about eight o'clock on the morning of January 31, I was on the marsh near my house and heard at short intervals peculiar cries, like the sound of many human voices, and stopped to listen. The wind was from the eastward, thick weather, and the sounds seemed to proceed from the direction of the ocean. Just at this time I was called by James E. Capps, a boy, who was in one of the upper windows of my house. I went with all speed to the house. I found my horse ready to be saddled. The boy said he had been to the beach and that there was a steamer ashore just abreast of my house, and that he thought there were women aboard. I mounted my horse and galloped to the beach abreast the wreck, waved my hat to the people on board to let them know assistance would be rendered, and galloped up the beach to give information to Station No. 4.

I noticed that the steamer was lying about 100 yards from the shore (it being then low water) and heading about west-southwest. She was square-rigged forward, fore-and-aft rigged aft, and her mainmast had fallen, also her smoke-stack. There were many people on board, a great number of them with cork jackets on. They were crying and screaming for help. The sea was very heavy, about as heavy as we usually have it here, and was breaking over the vessel, which had careened over slightly toward the sea to the southeast.

On my way to Station 4, about one-half mile to northward of wreck I noticed a metallic boat on the beach all burst to pieces. I supposed it was one of the steamer's boats. I had got within about one-quarter of a mile from the station when I met one of the patrol of Station 4 coming south. I asked him how far it was to the station. He said about a quarter of a mile. I told him there was a vessel ashore just abreast my house and rode on toward the station, the man following. I arrived at station about half past eight, as near as I can judge; did not see Keeper Chappell, but told his crew there was a vessel ashore just abreast my house, and they immediately commenced preparations.

Just then Captain Chappell came up from the beach, and I reiterated my information. He told the boys to get ready as soon as possible. He asked me if I thought he could get his boat down there in time. I told him I did not, the distance being great and the vessel fast breaking up. He then put the mortar apparatus in the hand-cart, and taking the medicine-chest, he and I started for the wreck, leaving the crew to follow with apparatus.

I soon after relieved the keeper of the medicine-chest and took it on my horse until within a mile of the wreck, when the keeper took the chest and told me to ride on quickly and see if I could relieve or assist those coming off the wreck. I went on with all speed, and on my arrival found about twenty people ashore alive, and sent a number to my house to be cared for; part went to N. E. K. Jones's. They all had on cork jackets when they came ashore. Saw no persons washing ashore at this time. I took off my hat and waved to those on board to let them know that assistance was coming from Station 4. I then went to my house, as my wife was sick, where I found a number of the survivors. Others had been there, and having warmed themselves, had gone back to the beach to render assistance.

I immediately went back to the beach ready to lend a hand, and commenced making fires, as it was chilly, and numbers were only partially dressed. About half past twelve o'clock the life-saving crew arrived with the mortar apparatus. By this time the wind had shifted to southwest, and the mortar apparatus was put in position ready for firing. The mortar was aimed to windward, as I supposed, to allow for drift. The first shot went over and to windward of the foremast, but the bight of line drifted to leeward, and the mainmast being gone there was nothing to fetch up the bight of the line and it passed over the stern of the vessel and overboard.

The line was then hauled in with shot attached by the life-saving crew, the mortar reloaded and fired again. The second shot was fired with apparent success, passing over the port fore-topsail yard-arm, the topsail being set and the jib stay. Saw a man go aloft to get the line, whom I afterward learned was the second mate; passed the line down to the crew on deck, who began pulling on it. They had got the tail-block, with tally-board attached, within about 150 feet of the side of the vessel when the line parted, there being a heavy current setting to the northward, and bringing, according to my judgment, a heavy strain upon the whip. The shot-line, minus the ball, was hauled in a second time by the crew of Station 4, together with the whip and tail-block.

Everything was got ready for a third shot, when the keeper found he was out of powder. I immediately sent to my house for powder. The mortar was then loaded for a third time and fired, when the line parted at once near the ball. The mortar was loaded with third and last ball, fired, and cut the line at the ball as before without taking any of the line.

Just at this moment the first officer of the stranded vessel came up and asked the crowd if there was any possible way of getting information to the adjacent station south; also to a telegraph-operator. Nothing was said for awhile. I noticed this and said, Yes, there is a way, that I had a horse and man whom I would send on horseback to Mr. Poyner, who would forward the telegram if he could; if not, I would see that the message was sent on. I sent the officer's telegram to Mr. Poyner, who sent word back that he would send the telegram on at once. This was about three in the afternoon. There was no one washing ashore at this time; they seemed to be waiting or holding on, evidently expecting assistance. So far as I know there was no attempt made by the people on board to send a line ashore by a cask or spar, but they hallooed and made motion to the effect that we were to look out for a line, and I learned afterward from one of the survivors that a man did jump overboard with a line in his teeth, intending to swim ashore with it, but they did not pay out the line fast enough to him, and he was compelled to relinquish his hold, and he swam ashore without it.

Keeper Chappell asked me if I could send a man back to the station for more balls. I told him I could not, as my horse had gone south with a telegram. Chappell then said he didn't know what he should do. So far as I know there was no horse to be had in the vicinity. No immediate assistance being rendered, the people began to jump overboard on doors and other fragments of joiner-work from the vessel. Then the station crew, assisted by N. E. K. Jones, James E. Capps, and myself, waded into the surf and rescued the drowning men. My dog (a large Newfoundland) also went in and dragged one man out.

Shortly afterward a number of citizens arrived from the mainland and elsewhere, among whom were Thomas J. Poyner, Captain Everton, wreck-commissioner, John Saunders, Alonzo Williams, Buchanan Williams, Thomas Litchfield, Sanford Dunton, John Dunton, and others. All united with us in saving life. Nearly if not quite all of those saved had on cork jackets. There was a strong current running to the northward carrying everything in that direction. There was one man swimming ashore who had on a cork jacket. He doubtless would have been saved, but a heavy sea breaking threw a lot of drift-stuff over him and he drowned. The beach was strewn with fragments of the wreck for a distance of at least two miles. About this time the captain of the stranded vessel came in toward the shore. Keeper Chappell and myself seized hold of him and brought him ashore. He had on a rubber suit (Merriman's).

Shortly after this (just before sunset) the foremast fell, covering a number of people under the sail and killing and crippling a great many and knocking them overboard. A few minutes after this the vessel broke up and disappeared almost entirely. There was a great struggle now to save life, as everybody who had remained on the vessel up to this time was overboard. We all pitched in and did our best. Don't know how many were saved in all, but think at least one hundred. At about sunset I left the beach; I was lame, having been struck by a drifting door while endeavoring to save life. I took the captain of the steamer to my house, where the purser and twelve others (survivors) were being properly taken care of. About seven in the evening a surfman from Station 5 came up and asked me if I could take care of a woman, one of the survivors. I told him yes, if they could get her here. I gave them my wife's cloak. Mr. Josephus Baum's cart being on the beach, she was taken to his house and properly taken care of.

When I left the beach saw a great number of survivors round the

fires. There were a great many more people there than I could take care of. I remained home all night, and next morning (Friday, 1st) went back to the beach, saw a number of the shipwrecked people, who said they had had nothing to eat for two days. I sent a number of them to my house at different times throughout the day for food and shelter. There was one man lying down on a bench by a fire suffering very much, having been injured internally by the wreck. I told Keeper Chappell of this, and he took his medicine-chest, went immediately to the man, gave him some brandy, and applied mustard-plasters. Josephus Baum soon came in a cart, took the man to his house, and properly cared for him. John Baker and others contributed clothing for the man.

The captain of the steamer directed me to employ hands to gather up the property and take care of it, and bury the bodies. We buried about twenty-three; all those whose names could be ascertained I wrote with a pencil or red chalk on the head-boards; and they are so buried as to be quickly and easily identified by myself. Jimmy Williams, Joshua Beaseley, Benjamin S. Harrison, and two others (names I don't remember) assisted in burying the dead. I saw no jewelry or trinkets of any kind on any of the bodies.

Joshua Beaseley told me that while they were burying the bodies one of the survivors came up and said he was searching for his chum; that he had $13 or $15 on him, and he wanted to get it and take it to his wife. He found his chum, knew him, and found the money, and took it from him in Beaseley's presence. We got through burying the bodies just before night. It was said there was a great deal of provision aboard, but I saw very little of it. What I did see was a few barrels of hard bread.

On Friday night I took care of sixteen persons, among whom were George A. Yoke, Thomas Cogan, B. J. White, R. Clark, and A. W. Newton.

This is all I know of the wreck of the steamer Metropolis.

S. C. BROCK.

Personally appeared before me and testified to the foregoing this 4th of February, 1878.

WALTER WALTON,
Assistant Inspector and Acting Superintendent.

JOHN J. DUNTON, being duly sworn, deposes and says:

I left my house, "Light-House Club," Currituck Beach, about nine o'clock, going down the beach south, and about 9.30 a. m. meeting survivors from the Metropolis coming to the house. Turning my horse around, riding back as soon as possible, finding some of the survivors at my house when I reached there, I gave them all the clothes I had except one suit, and putting a man on my horse sent him to Life-Saving Station 4 for assistance; but Mr. Brock being ahead of me my horse turned back home. I hitched him to the cart, and started to the wreck to render assistance, together with the first mate of the stranded vessel. I rode about one-eighth mile down the beach, when I overtook the life-saving crew, Station 4, with their hand-cart, shot-line, mortar, and whip-line. They were worn down, it being a bad beach for men to travel, and asked me for assistance. I hitched on to the cart and was glad to do so. I took them down to the wreck. We arrived at the wreck about twelve o'clock. The mortar was immediately got into

operation. The first shot parted the line. The second shot parted the line. The third shot went over the fore-topsail-yard, and the line caught on yard-arm. Second mate got the line, overhauled it down to the people on deck on the starboard side. The line was hauled across the fore-stay. The whip got half way to the ship when it fouled with something under water, and the shot-line broke. The fourth shot was then fired and parted line. There was a strong current running at the time, and too many men pulling at the shot-line. Two of the life-saving crew started immediately for the station for both powder and balls. Soon after that the people began to jump overboard and leave the ship. We all, citizens and life-saving crew, pulled the drowning men out of the surf. Surfman Gillett, Station 4, with a line tied around his body, and myself hold of the line, went in and pulled all out we could. A little before sunset the foremast fell, and the ship broke up completely. By dusk all that could be saved were rescued. I think we saved at least one hundred and twenty-five. I then returned home, found my house crowded with the survivors, about seventy in all, whom I fed and took care of to the best of my ability and means. They remained at my house until Saturday noon, when they left in the steamer Cygnet for Norfolk. I would like to state that on Friday evening, the day after the wreck, I was on my way home, coming up the beach I saw a man (one of the survivors) break open the surgeon's case of instruments. The first officer rebuked the man for it. This is all I know in relation to the wreck of the steamer Metropolis.

JOHN J. DUNTON.

Personally appeared before me and testified to the foregoing this 4th day of February, 1878.

WALTER WALTON,
Assistant Inspector and Acting Superintendent.

Mr. N. G. BURRIS, keeper of Currituck light-house, North Carolina being duly sworn, deposes and says:

About 10 o'clock in the forenoon of Thursday, January 31, I was informed by a messenger from the Light-House Club that there was a vessel ashore. This was, I think, before information was received by Life-Saving Station 4. The weather was foggy. I immediately started down the beach, and on my way was overtaken by the crew of Life-Saving Station 4, with mortar apparatus. I was accompanied by both the assistant light-keepers. We had got down some distance when we saw the body of a man washed up on the beach. We went along a little further and we saw the body of a woman also on the beach. They were insensible, but nevertheless we endeavored to resuscitate them, but without success. We went on a little farther, and we saw through the mist the wreck. Saw only one mast, smoke-stack gone, and the greater portion of the vessel broken up, and the deck covered with people. In a short time the mortar apparatus was brought into requisition. At the first fire the ball missed the wreck. The second shot, however, the line fell across the jib-stay, well up. The crew of the vessel began hauling on the shot-line; they had got the block within 75 yards of the vessel when the line parted. Then preparations were made for a third shot, the mortar fired and the line parted. They again got the mortar ready and the fourth shot fired, the line parted as before. During the firing I was busy faking the line down on the beach, and didn't know exactly what was going on on the beach. The people on board then saw there was nothing being done for their help, and began jumping overboard.

Then we all endeavored to save life to the best advantage; three men I noticed particularly who, by their extraordinary and prolonged exertions in rescuing life, seemed to distinguish themselves. Their names were John J. Dunton, and Surfmen Gillett and Gillikin, of Life-Saving Station 4. Mr. Brock, William Jones, with many other citizens also, were particularly noticeable in their eagerness and willingness to save life. About four o'clock in the afternoon, I, being completely worn out and exhausted, started for home. When near the light-house I turned and looked back and saw the mast had fallen, and no sign of the vessel remained. I took one of the survivors home with me, and shortly after my arrival a great many more of the survivors in an exhausted and destitute condition flocked to the house. I furnished food and shelter for sixty-one persons that night, and for about seventy-six for breakfast and dinner; also sheltered them that night and gave them a breakfast the following morning (Saturday). They left at noon for the steamer to Norfolk, Va. This is all I know in relation to the wreck of the steamer Metropolis.

N. G. BURRIS.

Personally appeared before me and testified to the foregoing, this 4th day of February, 1878.

WALTER WALTON,
Assistant Inspector and Acting Superintendent.

JAMES E. CAPPS, gunner and trapper, of Currituck Beach, North Carolina, being duly sworn, deposes and says:

About eight o'clock in the morning of Thursday, January 31, myself and N. E. Jones were walking across the beach toward the surf when I looked in a northerly direction and saw the mast of the vessel close in. The weather was foggy. I said to Jones, "Yonder is a vessel's mast," and we hurried toward it as quickly as possible. At first Mr. Jones said it must be a vessel abandoned, and that some vessel had taken the people off. As we got closer we could see people on board moving about; they waved their hats to us and hallooed for help. Mr. Jones then told me to go and inform Mr. Brock, so that he could go and let the life-saving crew at Station No. 4 know it. I hurried over to the sound shore and told Mr. Brock, who mounted his horse and rode at full speed north toward the station. I ran back to the beach to help to save the people struggling in the water. The vessel was lying in about a northeast and southwest direction and was already much torn up; the sea was breaking all over her; one mast was standing with sail set on it, and the smoke-stack was gone. At this time only a few men (natives) were on the beach; don't remember their names. We saved the people by taking hold of hands and wading into the surf. About nine o'clock Mr. Brock returned from the station, and afterward assisted in saving life. At about ten or eleven o'clock in the forenoon the mortar apparatus from Station 4 arrived. I was not immediately present when the mortar was first fired, being a little way up the beach. The first shot, I think, did not reach the vessel, but the second shot landed the line across the upper rigging. Saw one of the crew go aloft to get the line, which was then seized hold of by the crew below. Don't know whether they got the whip on board or not; think they did not, for the mortar was fired again with some powder which I brought from Mr. Brock's. I can't state how the apparatus worked because I went up the beach a short distance to see if there were any more people coming ashore. I went north because the current was running strong in that direction.

After the mortar apparatus failed the people began jumping overboard and trying to get on floating pieces of timber. The men on the beach

all turned in and helped the strugglers ashore. I didn't notice when the mast fell, as I was busy hauling the people out of the water. I worked, with others, until sunset; by that time the vessel had all broken up, and those that could be seen alive were saved. I think we rescued over 100. I noticed about 10 or 15 dead bodies, some of whom had on cork jackets, but were bruised. I left the beach about dark and went home to Mr. Jones's; saw Mr. Harrison, one of the survivors, there, who asked me and Jones to go down to the beach with him to look for the body of his wife. We found her laid out properly and covered up. We then returned back to the house. The next morning, Friday, 1st instant, Mr. Jones and I went to the beach near the scene of the wreck; saw the telegraph operator from Kittyhawk at work. At his request I waited on him, and carried his meals. The operator was working outdoors. I saw a number of natives on the beach; don't remember their names. This is all I know in relation to the wreck of the steamer Metropolis.

his
JAMES E. + KAPPS.
mark.

Sworn and subscribed to before me this 4th day of February, 1878.

WALTER WALTON,
Assistant Inspector and Acting Superintendent Sixth Life-Saving District.

Abstract of the documentary history of the steamship Metropolis, formerly the Stars and Stripes.

AS "STARS AND STRIPES."

First register (temporary) issued New York, May 22, 1861; built at Mystic, Conn., by Mallory; length, 147 feet; beam, 34 feet; depth, 9 feet; 407⅞⅞ tons, old measurement. Register surrendered July 30, 1861. Sold to United States.

Second register (permanent) issued Philadelphia, September 18, 1865. Purchased of the United States. No evidence produced of time or place of building. Remeasured and register issued by direction of Secretary of the Treasury, per letter of September 1, 1865. Length, 142.9 feet; beam, 35 feet; depth, 16 feet; tons, 484 (new measurement).

There were several changes of papers after this register until May 10, 1871, when an enrollment was issued at New York. Owners, John Hegeman, jr., Benjamin P. Lunt, and George D. Lunt; captain, Jere Lunt, all of New York. Surrendered at New York July 20, 1871. Cause of surrender stated, "vessel broken up."

AS THE "METROPOLIS."

First register (temporary) issued at Newburyport, Mass., August 28, 1871; not stated whether built or rebuilt. Owners, George D. Lunt, Benjamin P. Lunt, and John Hegeman, jr., copartners in ⅜; George D. Lunt ⅛ and C. W. Copeland ⅛, of New York, and M. H. Simpson ⅜, of Boston; captain, Jere Lunt. Length, 198.6 feet; beam, 34.2 feet; depth, 16 feet; tonnage, 879 tons. Purports to have been issued "on master carpenter's certificate." Register indorsed in pencil, "Not to be surrendered until master carpenter's certificate is produced."

The master carpenter's certificate was never produced, but the temporary register was surrendered at New York, September 29, 1871, and a permanent one issued upon the nondescript oath of Benjamin P. Lunt, George D. Lunt, and John Hegeman, jr., that the vessel was built for them in August, 1871, at Newburyport.

REPORT OF LIEUTENANT T. D. WALKER

UPON THE

WRECK OF THE SCHOONER BERLIN.

REPORT OF LIEUTENANT T. D. WALKER, ASSISTANT INSPECTOR OF LIFE-SAVING STATIONS, UPON THE WRECK OF THE SCHOONER BERLIN.

OFFICE OF INSPECTOR OF LIFE-SAVING STATIONS,
No. 16 *Broadway, New York, January* 2, 1878.

SIR: Respectfully referring to department letter of November 23, 1877, (S. I. K.,) directing me to proceed at once to Life-Saving Station No. 1, Point aux Barques, District No. 9, for the purpose of investigating all the circumstances connected with the late wreck of the schooner Berlin, which occurred on November 8, I have the honor to report that I reached Detroit on November 26, and was there joined by Superintendent Joseph Sawyer, who handed me a communication addressed to himself, under date of November 12, 1877, with the names of R. Cooley, C. H. Cooley, F. Dhyse, and Frank Wilson appended as signatures thereto, said letter charging that on November 9, at 5 a. m., a telegraphic dispatch was transmitted from the vicinity of the wreck of the schooner Berlin to the keeper of Life-Saving Station No. 1, at Point aux Barques, informing him of the disaster; that said keeper, together with his crew, failed to arrive in response to the summons until sundown; that although the distance required to be traveled was but five miles and the weather calm enough to launch and manage a common yawl-boat, the surf-boat was brought on a wagon; and that by such tardy action three men were permitted to perish. The following names are also mentioned as those of persons cognizant of the alleged facts recited in the letter: Captain Peer, Captain Walters, Captain White, Oliver Bosely, James Hamilton, James Calhan, and Eugene Foote.

Leaving Detroit on the 27th, we proceeded to Port Hope, Michigan, by steamer; and as it was deemed necessary, in order to obtain all the information possible, to visit Port Austin, Grindstone City, Huron (a point some three miles inland from the latter place), the light-house at Point aux Barques, and also the life-saving station, a team was hired to convey us thither. Of the persons whose names appear as signers to the letter containing the charges, but two could be found, viz: C. H. Cooley and R. Cooley, the latter, father of C. H. Cooley, denying that he signed the letter, although admitting that he had previously authorized the use of his name at such time as a letter might be sent—a comparison of dates thus clearly indicating that a pretext for such letter had been anxiously sought for by the parties above named. Frederick Dhyse and Frank Wilson were absent at a lumber-camp, several miles distant. Of those named in the body of the letter, Captain White, James Hamilton, James Calhan, and Eugene Foote could not be found, although a messenger, acquainted with their usual abiding-places, was dispatched in search of them.

The direct evidence obtained during the investigation is embodied in the sworn statements of C. H. Cooley, R. Cooley, Frank Walters, A. G. Peer, Oliver Bosely, George Robertson, James Green, Charles E. Thompson, Andrew Shaw, Keeper C. E. McDonald, and Surfman Henry Martin. Referring to the evidence of Keeper McDonald and Surfman Martin, I

would respectfully state, in view of the fact that the affidavits of Messrs. Robertson, Green, Thompson, Shaw, and Bosely were so emphatic in contradiction of the charges against McDonald, that upon reaching the station on November 30, and reducing to writing the statements of McDonald and Martin, and after making a preliminary examination of the other men composing the crew, under oath, the testimony was found to agree so closely that I deemed it unnecessary to reduce each to writing, but caused them to affix their signatures to the statement of the latter, to which they unhesitatingly consented. This fact is submitted as a sufficient reason for the omission of their testimony in full. Letters addressed to Superintendent Sawyer by County Prosecuting-Attorney R. Winsor, of Port Austin, James Green, Ira West, and George Robertson, of Grindstone City, and Andrew Shaw, principal keeper of Point aux Barques light-house, are also inclosed, and in transmitting these and the sworn evidence to the department for its consideration, I desire to state that during the course of the investigation, and in conversations with Mr. Winsor above named, Mr. George H. Worthington, proprietor of extensive quarries in the States of Ohio and Michigan, and other persons in the vicinity of the scene of the wreck, it was clearly demonstrated that public sentiment completely exonerated the crew of the station from blame in the matter; in fact, not one word of reproach was uttered by those who witnessed the affair and were conversant with all the circumstances surrounding it, the unanimous opinion being that the charges emanated from a few irresponsible persons of questionable character residing some miles back in the interior, who were not present at the time the boat went off to the rescue, and who probably preferred the charges at the instigation of the man named Frank Walters. In this connection it will be perceived that the latter individual shrewdly declined to sign his name to the document, although he states that it was written at his house.

After a careful review of the evidence, &c., the facts attending the disaster appear to have been as follows: The night of November 8, was dark, with a strong gale blowing from northeast, and rain. The schooner Berlin, of Buffalo, with six persons on board, all told, grounded at the outer edge of Burnt Cabin Point Reef, several miles in a west-northwest direction from Point aux Barques light-house, at about 7 or 8 o'clock p. m. During the night she gradually worked inshore, and at about daylight on the following morning (9th) commenced breaking up; the distance at which she then lay being about one-half a mile from the shore.

The course pursued by the unfortunate crew during this interval does not appear, although one man perished while in the rigging. At daylight, the master, A. M. Johnston, of Buffalo, and another man were washed overboard and lost. Soon after daylight, the master's son, who was one of the crew, overcome with despair at the loss of his father, became an easy victim to the force of the seas that swept over the vessel, and he fell, entangled in the wreckage floating to leeward of what remained of the hull.

In the mean time inhabitants of Grindstone City had discovered the vessel, and Messrs. Robertson and Peer, after surveying the situation, called at the telegraph-office for the purpose of notifying the crew of Station No. 1, at Point aux Barques, a dispatch to that effect being forwarded by James Green. This action appears to have been absolutely necessary in order to apprise the station-men of the disaster, as the natural curvature of the coast-line, in a northerly and westerly direction, would effectually prevent the discovery of a vessel ashore in

the direction of Grindstone City at a much less distance from the station than where the Berlin struck; and any information of that nature must necessarily reach the station from persons living in that vicinity. The evidence of the telegraph-operators confirms the statement of Keeper McDonald that the message did not reach the station until about ten o'clock, and disproves the charge that a message was sent at five o'clock, some time before daylight. At the hour the dispatch was received the sea was running so high and the prospect of pulling the boat broadside to the breakers a distance of eight or nine miles so extremely hazardous that Keeper McDonald determined to transport his boat by land to the scene of the wreck. He therefore, in view of the uneven and heavy condition of the roads, procured, as soon as it was possible, the use of two pairs of horses, one pair from Mr. Andrew Shaw, of the light-house near by, and the other from Mr. Dixon, residing two or three miles distant. Personal observation of the roads traversed in order to reach the scene of the wreck leads me to the belief that McDonald's judgment in this course was correct. The boat arrived abreast the wreck at about 3 p. m., and was at once launched and pulled for it; there being but a portion of the bow above water, and that at the distance from the shore previously indicated, viz, one-half a mile. Two men were found clinging to the wreck in a benumbed and exhausted condition, and after taking them into the boat the body of the captain's son was also recovered and all conveyed to the shore. Upon landing active measures were at once taken to revive the survivors, one of the surfmen being sent to a neighboring store for some brandy as a stimulant.

About this time (3.30 p. m.) word was received from a messenger that a second vessel, the Triumph, was ashore nearly high and dry about one and a half miles west of the Berlin, and the surf-boat was at once placed on the carriage for conveyance thither, but upon the arrival of a second person with intelligence that the crew were safely landed, the keeper started off on horseback alone to learn the particulars, after instructing his men to properly care for those saved from the Berlin. This done, the crew of the station in charge of the keeper remained in the vicinity until the afternoon of Sunday, November 11, in order to search for the remaining bodies, and save such parts of the wreck as might be washed on shore; during which time one body was recovered on the 10th, and decently interred by the crew on the day following.

After doing all in their power to make the two survivors comfortable, and procuring for them transportation to Port Huron, *en route* to Buffalo, and placing the body of the captain's son in their charge, Keeper McDonald and his crew returned in their boat, under sail, on the afternoon of the 11th.

The consequences resulting from the wreck may be summed in brief as follows: Of six persons on board, two were saved and four lost; two of the bodies of the latter being recovered and properly cared for.

It is to be deplored that assistance could not be rendered at an earlier hour, but I was informed by Mr. Robertson that he considered it very doubtful if more could have been accomplished even if the boat had reached the spot when the vessel was first discovered in the early morning light, as the masts fell and the vessel became a complete wreck about that time. Her speedy breaking up is explained by noting the fact that she was twenty-four years old and in a very unsound condition.

In view of the foregoing, and the additional fact that some difficulty was encountered in obtaining the statements of the two Cooleys and Frank Walters, I respectfully submit the opinion that the charge of dereliction of duty against Keeper McDonald has not been sustained, and that no just ground existed for the complaint.

Before closing this report I would respectfully recommend approval and payment of the expense incurred by Keeper McDonald for hire of teams, as without such aid it is doubtful if the boat could have reached the locality of the wreck before nightfall, the result of which would have rendered the journey fruitless, as the two men were nearly exhausted when rescued.

Absence from New York upon special duty in the third district under department order of November 28, 1877, (S. I. K.), has prevented the submission of this report at an earlier date.

Very respectfully, your obedient servant,

THOMAS D. WALKER,
Lieutenant United States Revenue Marine,
Assistant Inspector.

Hon. JOHN SHERMAN,
Secretary of the Treasury.

APPROPRIATIONS AND EXPENDITURES.

STATEMENTS SHOWING THE APPROPRIATIONS AND EXPENDITURES FOR THE MAINTENANCE OF THE LIFE-SAVING SERVICE FOR THE FISCAL YEAR ENDING JUNE 30, 1878.

APPROPRIATION—LIFE-SAVING SERVICE, 1878.

For salary of one superintendent of life-saving stations on the coasts of Maine and New Hampshire, district No. 1	$1,000 00	
For salary of one superintendent of life-saving stations on the coast of Massachusetts, district No. 2	1,000 00	
For salary of one superintendent of life-saving stations on the coast of Long Island, district No. 3	1,500 00	
For salary of one assistant superintendent of life-saving stations on the coast of Rhode Island, district No. 3	500 00	
For salary of one superintendent of life-saving stations on the coast of New Jersey, district No. 4	1,500 00	
For salary of one superintendent of life-saving stations on the coasts of Delaware, Maryland, and Virginia, district No. 5	1,000 00	
For salary of one superintendent of life-saving stations on the coasts of Virginia and North Carolina, district No. 6 ..	1,000 00	
For salary of one superintendent of life-saving stations on the coast of Florida, district No. 7	1,000 00	
For salary of one superintendent of life-saving stations on the coasts of Lakes Erie and Ontario, district No. 8	1,000 00	
For salary of one superintendent of life-saving stations on the coasts of Lakes Huron and Superior, district No. 9	1,000 00	
For salary of one superintendent of life-saving stations on the coast of Lake Michigan, district No. 10	1,000 00	
For salaries of 150 keepers of life-saving stations, at $200 each	30,000 00	
For salaries of 5 keepers of houses of refuge on the coast of Florida, at $40 per month each	2,400 00	
For pay of crews of experienced surfmen at such stations and for such periods as the Secretary of the Treasury may deem necessary and proper	146,000 00	
For compensation to volunteers at life-boat stations.........	8,160 00	
Total		$198,060 00

EXPENDITURES.

Salary of superintendent of life-saving stations in district No. 1	$1,000 00
Salary of superintendent of life-saving stations in district No. 2	1,000 00
Salary of superintendent of life-saving stations in district No. 3	1,500 00
Salary of assistant superintendent of life-saving stations in district No. 3	500 00
Salary of superintendent of life-saving stations in district No. 4	1,500 00
Salary of superintendent of life-saving stations in district No. 5	1,000 00
Salary of superintendent of life-saving stations in district No. 6	250 00

Salary of superintendent of life-saving stations in district No. 7	$1,000 00	
Salary of superintendent of life-saving stations in district No. 8	1,000 00	
Salary of superintendent of life-saving stations in district No. 9	1,000 00	
Salary of superintendent of life-saving stations in district No. 10	1,000 00	
		$10,750 00
Pay of 145 keepers, districts Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10, quarter ending September 30, 1877	7,600 00	
Pay of 145 keepers, districts Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10, quarter ending December 31, 1877	7,536 52	
Pay of 147 keepers, districts Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, quarter ending March 31, 1878	7,588 58	
Pay of 147 keepers, districts Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, quarter ending June 30, 1878	7,656 13	
		30,381 23
Pay of 36 surfmen in district No. 1, November 1, 1877, to April 30, 1878, inclusive	8,640 00	
Pay of 84 surfmen in district No. 2—24, November 1, 1877, to April 30, 1878, inclusive, and 60, November 1, 1877, to April 15, 1878, inclusive	18,960 00	
Pay of 204 surfmen in district No. 3—42, November 15, 1877, to April 15, 1878, inclusive, and 162, November 15, 1877, to March 31, 1878, inclusive	37,560 00	
Pay of 228 surfmen in district No. 4—36, November 15, 1877, to April 15, 1878, inclusive, and 192, November 15, 1877, to March 31, 1878, inclusive	41,735 42	
Pay of 48 surfmen in district No. 5, December 1, 1877, to March 31, 1878, inclusive	7,661 76	
Pay of 60 surfmen in district No. 6, December 1, 1877, to March 31, 1878, inclusive	9,579 92	
Pay of 18 surfmen in district No. 8, September 1 to December 15, 1877, inclusive, and April 1 to May 31, 1878, inclusive	3,948 30	
Pay of 56 surfmen in district No. 9—32, September 1 to December 15, 1877, inclusive, and April 1 to May 31, 1878, inclusive, and 24, September 1 to November 25, 1877, inclusive, and May 15 to June 30, 1878, inclusive, and 6, June 1 to 30, 1878, inclusive	13,111 14	
Pay of 18 surfmen in district No. 10, September 1 to November 30, 1877, inclusive, and April 1 to May 31, 1878, inclusive	3,600 00	
		144,796 54
Pay of 36 surfmen in district No. 1, for one day's drill and exercise		108 00
Pay of surfmen in district No. 1, for services at wrecks which occurred between July 1 and November 1, 1877, and between May 1 and June 30, 1878, periods when crews were not required to reside at the stations	177 00	
Pay of surfmen in district No. 2, for services at wrecks which occurred between July 1 and November 1, 1877, and between May 1 and June 30, 1878, periods when crews were not required to reside at the stations	42 00	
Pay of surfmen in district No. 3, for services at wreck October 5, 1877	18 00	
Pay of surfmen in district No. 4, for services at wrecks which occurred between July 1 and November 15, 1877, and between April 15 and June 30, 1878, periods when crews were not required to reside at the stations	57 00	
Pay of surfmen in district No. 6, for services at wreck November 24, 1877	100 00	
Pay of surfmen in district No. 8, for services at wrecks which occurred between July 1 and September 1, 1877, and between December 15, 1877, and April 1, 1878, and between June 1 and 30, 1878, periods when crews were not required to reside at the stations	38 00	
Pay of surfmen in district No. 10, for services at wrecks which occurred between July 1 and September 1, 1877, and be-		

tween December 1, 1877, and April 1, 1878, and between June 1 and 30, 1878, periods when crews were not required to reside at the stations	$144 00	
		$576 00
Total expenditures from appropriation Life-Saving Service, 1878		186,611 77
Balance of available funds July 1, 1878		11,448 23
		198,060 00

APPROPRIATION—LIFE-SAVING SERVICE, CONTINGENT EXPENSES, 1878.

For fuel for 155 stations and houses of refuge; repairs and outfits for the same; supplies and provisions for houses of refuge and for shipwrecked persons succored at stations; traveling-expenses of officers under orders from the Treasury Department; and contingent expenses, including freight, storage, repairs to apparatus, medals, stationery, advertising, and miscellaneous expenses that cannot be included under any other head of life-saving stations, life-boat stations, and houses of refuge on the coast of the United States	$40,000 00

EXPENDITURES.

Apparatus	$10,462 39	
Books, charts, stationery, &c	1,055 28	
Bunting for signal flags	2,793 85	
Care of stations pending appointment of keepers	25 41	
Copying, from stenographic notes, testimony taken in investigations	162 00	
Equipments	809 91	
Experiments in improving mortars, guns, shot-lines, &c	566 90	
Flagstaffs for display of signals	2,175 00	
Freight, packing, storage, telegraphing, &c	1,603 18	
Fuel for stations	4,764 08	
Furniture, supplies, &c	5,067 86	
Hire of horses to assist in transporting apparatus from stations to wrecks	91 60	
Lithographing and engraving	502 21	
Medals	487 45	
Recording deeds	3 35	
Removal of stations on account of encroachment of the sea, &c.	986 98	
Rent of inspector's office, New York City	200 00	
Repairs to stations and apparatus	2,681 86	
Sustenance of persons rescued from wrecked vessels	206 55	
Traveling-expenses of officers	5,126 45	
Total expenditures from appropriation, Life-Saving Service, contingent expenses, 1878		$39,772 31
Balance, available funds July 1, 1878		227 69
		40,000 00

The above statements differ from the statement of expenditures by warrants for the year in the following particulars:

			Life-Saving Service, 1878.	Life-Saving Service, contingent expenses, 1878.
Amounts expended as per statement of expenditures by warrants			$186,510 25	$39,475 74
Items of expense payable from the appropriation Life-Saving Service, 1878, which were not included in expenditures by warrants, as not appearing on the books of the Warrant Division until after June 30, 1878		$126 00		
Less repayment not appearing on the books of the Warrant Division until after June 30, 1878	$20 08			
Less item chargeable to Life-Saving Service, 1877, improperly charged to Life-Saving Service, 1878, and not corrected until present fiscal year	4 40			
		24 48		
			101 52	....
Items of expense payable from the appropriation Life-Saving Service, contingent expenses, 1878, which were not included in expenditures by warrants, as not appearing on the books of the Warrant Division until after June 30, 1878		$361 87		
Less repayment not appearing on the books of the Warrant Division until after June 30, 1878	$58 85			
Less balance in hands of disbursing-clerk June 30, 1878, belonging to the appropriation for contingent expenses	6 45			
		65 30	....	296 57
Net expenditures from the appropriations for the year			186,611 77	39,772 31

At the beginning of the fiscal year there remained on hand available from the appropriations of the preceding year the following:

	Life-Saving Service, 1877.	Life-Saving Service, contingent expenses, 1877.
Unexpended balances July 1, 1877	$27,231 07	$12,111 53
To which repayments have been made as follows	146 37	43 38
Total available	27,377 44	12,154 91

The expenditures from these balances during the last fiscal year, made in payment of indebtedness standing over from the preceding year, were as follows:

Life-Saving Service, 1877, available, as above			$27,377 44
Balance due officers and employés, district No. 10, for quarter ending June 30, 1877, as follows.			
1 superintendent	$250 00		
11 keepers	48 33		
12 surfmen	432 00		
		$730 33	
Pay of crew of life-boat station No. 7, district No. 10, at wreck of scow June 3, 1877		120 00	
Pay of officers, district No. 7, for quarter ending June 30, 1877, as follows:			
1 superintendent	$250 00		
5 keepers	600 00		
		850 00	

Pay of surfmen in districts Nos. 1, 4, and 5, for services at wrecks which occurred during a period when crews were not required to reside at the stations	$120 00	
Balance due Superintendent D. P. Dobbins on former settlement.	03	
Amount carried by warrant and counter-warrant from appropriation for Life-Saving Service, 1876, to Life-Saving Service, 1877, improperly paid from former appropriation, account of Superintendent J. M. Richardson	3 00	
		$1,823 36
Balance unexpended July 1, 1878		25,554 08
		27,377 44

Life-Saving Service, contingent expenses, 1877, available, as heretofore stated		$12,154 91
Apparatus	$9,639 40	
Flag-staffs for display of signals	1,051 00	
Freights, &c	76 94	
Medals	57 00	
Models of apparatus	20 00	
Moving station	35 00	
Rent of inspector's office, New York City	100 00	
Repairs to stations and apparatus	24 96	
Stationery	1 88	
Supplies	84 77	
Traveling-expenses of officers	566 02	
		$11,656 97
Balance unexpended July 1, 1878		497 94
		12,154 91

There also remained on hand at the beginning of the year, available from appropriations of 1876, the following:

	Life-Saving Service, 1876.	Life-Saving Service, contingent expenses, 1876.
Unexpended balances July 1, 1877	$52,594 70	$143 02
To which repayments have been made as follows	9 59	
Total available	52,604 29	143 02

The expenditures from these balances during the last fiscal year were as follows:

Life-Saving Service, 1876, available, as above stated		$52,604 29
Pay of 15 surfmen, in district No. 4, for services at wrecks which occurred during a period when crews were not required to reside at the stations	$45 00	
Balance unexpended, covered into the Treasury June 30, 1878	52,559 29	
		$52,604 29

Life-Saving Service, contingent expenses, 1876, available, as above stated		$143 02
Signal-flags	$141 61	
Balance unexpended, covered into the Treasury June 30, 1878	1 41	
		$143 02

The total net expenditures for the maintenance of the Life-Saving Service during the fiscal year ending June 30, 1878, were, therefore, as follows:

Life-Saving Service, 1878	$186,611 77	
Life-Saving Service, 1877	1,823 36	
Life-Saving Service, 1876	45 00	
Aggregate		$188,480 13
Life-Saving Service, contingent expenses, 1878	$39,772 31	
Life-Saving Service, contingent expenses, 1877	11,656 97	
Life-Saving Service, contingent expenses, 1876	141 61	
Aggregate		$51,570 89
Total		240,051 02

There remained standing to the credit of the respective appropriations at the close of the fiscal year ending June 30, 1878, and still available, as heretofore stated, the following balances:

Life-Saving Service, 1878	$11,448 23
Life-Saving Service, 1877	25,554 08
Life-Saving Service, contingent expenses, 1878	227 69
Life-Saving Service, contingent expenses, 1877	497 94

The balances of "Life-Saving Service, 1876," and "Life-Saving Service, contingent expenses, 1876," remaining on hand at the close of the year ending June 30, 1878, were covered into the Treasury at that date, as before stated.

TABLE OF WRECKS

WITHIN THE FIELD OF OPERATIONS OF LIFE-SAVING SERVICE.

SEASON OF 1877-'78.

LIFE-SAVING SERVICE.—TABLE

DISTRICT NO. 1.—COASTS OF

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
July 10	Southeast Point of Great Spruce Island.	3	Brig Ellen M. Mitchell.	Machias, Me	Eaton	395
July 18	Seal Cove Ledges, southwest of Cross Island.	2	Brig Maid of Llangollen.	St. John's, N. B.	McKellar	235
July 21	Spruce Point, Cross Isle, one-half mile southwest from station.	2	Sc. C. H. Dyer	Windsor, N. S	Hill	110
July 19	Little Riverhead	2	Sc. H. E. Wellman*	Calais, Me	Gove	112
July 19	Machias, Seal Island	2	Bark Nereid*	Dundee, Scotland	Collin	350
Aug. 9	Black Rock, entrance of Quoddy Bay.	1	Sc. Stephen J. Watts†	Machias, Me	Driscoe	105
Aug. 13	Grindstone Ledge, Muscle Ridge Channel.	4	Sc. Venilla	Swan's Island, Me	Sprague	67
Aug. 16	Gun Rock, Quoddy Narrows	1	Sc. H. T. Townsend	Pembroke, Me	Wilder	184
Sept. 11	Dog Fish Ledges, west entrance Cross Island Narrows.	2	Sc. Leader	Sullivan, Me	White	8
Sept. 22	Old Man Isle, two miles east of station.	2	Sc. Montrose	Calais, Me	Hillman	108
Sept. 23	Hurricane Ledge, Muscle Ridge Channel.	4	Sc. Emma W. Day	Stockton, Me	Griffin	61
Oct. 1	East-northeast one mile from Black Head.	3	Bark Evangeline	Belfast, Ireland	O'Hara	198
Oct. 5	Post Cove Ledge	5	Sc. Friendship	Rockland, Me	Closson	33
Oct. 19	Yellow Ridge Ledge, entrance to Muscle Ridge Channel.	4	Sloop Mary Burnham	Portland, Me	Wiley	8
Nov. 6	Hay Island Ledge, mouth of Seal Harbor.	4	Sc. Allie Oakes	Rockland, Me	Pillsbury	96
Nov. 19	Long Ledge, Seal Harbor	4	Sloop Mary Burnham	Portland, Me	Wiley	8
Dec. 2	South Breaker, near White Head.	4	Sc. Kate Walker	Bangor, Me	Herrick	140
Dec. 8	Sawyer's Wharf, Seal Harbor	4	Sloop Hyperion	Rockland, Me	Grant	46
1878.						
Jan. 11	Norton's Island, Seal Harbor	4	Sc. J. P. Merriam	Bangor, Me	Dean	64
Jan. 22	Entrance of Head Harbor, Me.	3	Sc. W. E. Duryea‡	Windsor, N. S	Le Cone	114
Feb. 1	Round Shoal, Quoddy Bay	1	Sc. Commodore Kearney.	Calais, Me	Tomson	98
Mar. 16	Otter Island Ledge, four miles northeast from station.	4	Sc. Post Boy	Rockland, Me	Gross	45
Apr. 4	Long Ledge, Seal Harbor	4	Sc. Louisa Smith	Castine, Me	Webber	144
Apr. 18	Neck Beach, Biddeford Pool, Me.	5	Sc. Wm. E. Leggett	Bangor, Me	Ulmer	83
Apr. 26	Southwest side of Matinicus Island.	4	Sc. Cameo	Belfast, Me	Stover	47
Apr. 27	Quoddy Head, near Seal Rock	1	Sc. Ella M. Pennell	Machias, Me	Thompson	194
May 5	Great Head, two and a half miles east of station.	2	Ship John Clark	Boston, Mass	Ross	1,079
May 9	Hampton Beach, four and a half miles south of station.	6	Sc. Hampden §	Bangor, Me	Smith	150
May 12	Dog Fish Ledges, west entrance Cross Island Narrows.	2	Sc. Clifton	Ellsworth, Me	Nutter	24
May 13	East Point of Ash Island	4	Sc. Eva L. Leonard	Boston, Mass	Dorr	115
May 21	Man Island Ledge, entrance of Head Harbor.	3	Sc. C. H. Dyer	Parsboro', N. S	Blake	79
June 14	White Head Island, near station.	4	Sc. Ralph Howes	Belfast, Me	Gotchel	143
	Total					

* Assistance rendered by neighboring fishermen. None by station.
† Assistance rendered by steamer. ‡ Assisted by passing schooner.
§ No assistance rendered by station.

OF WRECKS, SEASON OF 1877-'78.

MAINE AND NEW HAMPSHIRE.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Boston, Mass	Machias Port, Me	....	$25,000	....	$25,000	$20,000	$5,000	11	11	..	....	...
Ireland......	St. John's, N. B..	....	2,300	....	2,300	2,300	......	8	8	..	....	...
Bridgport, Conn.	Windsor, N. S ...	Flour and meal.	1,700	$150	1,850	1,850	......	5	5	..	....	...
Boston, Mass	Calais, Me.......	....	4,000	....	4,000	......	4,000	6	6	..	....	...
....do	St. John's, N. B..	....	20,000	....	20,000	......	20,000	11	11	..	....	...
St. John's, N. B.	New York, N. Y	Lumber .	2,000	1,500	3,500	2,900	600	5	5	..	....	...
Swan's Island, Me.	Fishing Grounds	Fish and outfit.	3,000	2,000	5,000	1,600	3,400	15	15	..	....	...
Portsmouth, N. H.	Pembroke, Me ..	....	5,000	....	5,000	4,500	500	5	5	..	....	...
Sullivan, Me	Calais, Me.......	....	200	....	200	185	15	3	3	..	....	...
New York...	St. John's, N. B..	....	1,500	436	1,936	......	1,936	4	4	..	....	...
Stockton, Me	Rockport, Mass .	Hay	4,000	650	4,650	3,825	825	4	4	..	....	...
St. John's, N. B.	Dungarvan, Ireland.	Deals....	9,000	3,500	12,500	12,500	......	8	8	..	....	...
Rockland, Me	Fishing	Salt and fish.	300	150	450	......	450	4	4	..	....	...
Muscle Ridge Island, Me.	Herring Gut, Me	Lobsters	1,700	140	1,840	1,840	......	2	2	..	....	...
New York	Bangor, Me	Corn and flour.	3,000	4,000	7,000	6,800	200	4	4	..	....	...
Herring Gut, Me.	Ash Point.......	....	1,700	....	1,700	1,600	100	2	2	..	2	2
New York ..	Bangor, Me	Coal.....	3,000	1,500	4,500	4,500	......	6	6	..	....	...
Rockland, Me	Spruce Head, Me	....	600	....	600	400	200	1	1	..	....	...
Boston, Mass	Bucksport, Me ..	Flour....	2,000	1,600	3,600	3,400	200	3	3	..	3	21
New York ..	Cannon, N. S	General..	4,500	10,000	14,500	200	14,300	7	7	..	....	...
....do	Calais, Me	Provisions.	2,000	3,800	5,800	5,100	700	5	5	..	....	...
Rockland, Me	Boston, Mass....	Lime and barrels.	1,200	520	1,720	200	1,520	3	3	..	....	...
Calais, Me...	Providence, R. I	Lumber .	8,000	2,000	10,000	9,800	200	5	5	..	....	...
Newburyport, Mass.	Bangor, Me	....	2,000	....	2,000	1,950	50	4	4	..	....	...
Boston, Mass	Belfast, Me	General..	1,000	5,000	6,000	3,000	3,000	4	4	..	1	1
Nova Scotia	Alexandria, Va .	Rock plaster.	3,000	820	3,820	......	3,820	6	6	..	6	24
Sandy Hook	Calais, Me.......	....	30,000	....	30,000	......	30,000	20	18	2	....	...
Hoboken, N. J.	Portsmouth, N. H.	Coal.....	4,000	1,000	5,000	900	4,100	5	5	..	....	...
Boston, Mass	Calais, Me	Flour....	150	900	1,050	110	940	2	2	..	....	...
....do	Bucksport, Me ..	Fishing outfit.	7,000	2,000	9,000	8,700	300	9	9	..	....	...
Maitland, N. S	Belfast, Me......	Plaster.	1,600	112	1,712	......	1,712	4	4	..	....	...
Bath, Me....	....do	....	9,000	....	9,000	8,850	150	4	4	..	....	...
....	....	....	163,450	41,778	205,228	107,010	98,218	185	183	2	12	48

DISTRICT No. 2.—COAST

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
July 1	Newburyport Bar, north side of river.	1	Sc. Ann Maria	Gloucester, Mass	Robbins	42
July 2	Five miles southeast of station.	4	Yacht Teaser	Boston, Mass	Appleton	......
July 31	Two miles south of station	11	Sc. John Dove	Gloucester, Mass	Smith	58
Aug. 14	One mile south of station	11	Sc. Goddess	Harwich	Kelly	220
Nov. 16	Three miles northeast of station.	12	Sc. Wm. B. Daisly	Boston, Mass	Smith	96
Dec. 14	Outer Bar, one-half mile east of station.	12	Sc. Francis Hatch	Rockland, Me	Stearns	92
1878.						
Jan. 3	One-half mile north of station	8	Sc. Addie P. Avery	Port Jefferson, L. I	Thompson	332
Jan. 3	One and a quarter mile south of station.	8	Sc. Miles Standish	Provincetown, Mass.	Bangs	53
Jan. 3	One-third mile south of station.	8	Sc. Pow-wow	....do	Eaton	56
Jan. 3	Two and a half miles north of station.	11	Sc. Sea Lion	St. John's, N. B	McIntire	100
Jan. 3	Two miles north of station	11	Sc. J. G. Babcock	Egg Harbor, N. J	Babcock	276
Jan. 4	Chatham Bar, three miles northeast of station.	12	Sc. Granite State	Barnstable, Mass	Crocker	167
Jan. 6	Off Highlands, Cape Cod	12	Sc. American Chief	Rockland, Me	Snow	78
Jan. 16	Four miles north of station	10	Sc. Edna Harwood	Baltimore, Md	Turner	283
Mar. 20	Annisquam Bar	2	Sc. Enterprise	Wells, Me	Perkins	42
Mar. 21	Shovelful Shoal	13	Sc. Highlander	Ellsworth, Me	Wood	92
Apr. 2	Near Ipswich Light, five miles from station.	2	Sc. John Mashon	York, Me	Webber	55
Apr. 16	Opposite station	10	Fish-boat		Sparrow	......
Apr. 20	Ipswich Bar, five miles from station.	2	Sc. John Mashon	York, Me	Webber	55
May 26	Near High Pine Ledge	3	Sail-boat		Watson	......
	Total					

DISTRICT No. 3.—COASTS OF RHODE

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
July 16	Black Rock Point, south part of Block Island.	3	Sc. William S. Scull*	Philadelphia, Pa	Barret	409
July 19	Flat Beach, 2 miles west of Station.	21	Sc. Adelaide M. Aldridge.*	Dennis, Mass	Handren	300
July 20	Southwest point Block Island	3	Sc. Bagaduce	Castine, Me	Clement	133
Aug. 31	One-half mile west-southwest Montauk Light.	5	Brig Idalia†	Georget'n, Prince Edward Island.	Graham	208
Oct. 5	Opposite Station	15	Sc. Armstrong	New Haven, Conn.	Etheridge	392
Nov. 24	South of Swift Creek	28	Sloop Mattie	Canarsie, L. I	Davis	10
Dec. 6	East end of Jones Beach	25	Sc. Gen. Connor	Boston, Mass	Shute	273
Dec. 9	Opposite Station	16	Brig Ponvert	New York	Johns	296
Dec. 15	Flat Beach, 2 miles west of Station.	21	Sc. Elizabeth Edwards.	Philadelphia, Pa	Dalbow	316
1878.						
Jan. 5	One mile east of Lucy's Inlet.	30	Brig Sarah M. Loring	Portland, Me	Loring	483

* No assistance by station.
† No assistance needed from station.

OF MASSACHUSETTS.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Newburyp'rt, Mass.	George's Banks	....	$2,000	....	$2,000	....	$2,000	8	8	..	8	8
Chatham, Mass.	Boston, Mass	....	700	....	700	$600	100	2	2	..	....	....
George's Banks.	Gloucester, Mass	Fish and salt.	4,500	$58	4,558	4,058	500	10	10	..	....	....
Hallowell, Me.	Albany, N. Y	Granite	6,000	1,500	7,500	....	7,500	5	5	..	....	....
Boston, Mass	Port Antonio, Jamaica.	....	6,000	....	6,000	5,740	260	6	6	..	....	....
Rondout, N. Y.	Boston, Mass	Cement	6,000	1,700	7,700	....	7,700	5	5	..	5	10
New York	....do	Chalk	11,000	1,500	12,500	....	12,500	6	....	6	....	....
Provincetown, Mass	Fishing	Fish and outfits.	2,000	150	2,150	....	2,150	12	12	..	12	12
....do	....do	...do	2,500	100	2,600	....	2,600	15	10	5	10	10
Hoboken, N. J	St. John's, N. B	Coal	5,000	500	5,500	....	5,500	5	5	..	5	10
....do	Boston, Mass	...do	12,000	1,000	13,000	....	13,000	7	....	7	....	....
New York	....do	...do	2,000	1,000	3,000	....	3,000	5	5	..	5	10
....do	Portsm'uth, N.H.	...do	5,000	700	5,700	5,625	75	4	4	..	....	....
Port Maria, Jamaica.	Boston, Mass	Logwood & cocoa nuts.	6,000	7,000	13,000	7,500	5,500	8	8	..	4	8
Wells, Me	....do	Wood, fish, potatoes, & eggs.	1,000	800	1,800	150	1,650	6	6	..	5	15
Amboy, N. J	Salem, Mass	Coal	4,000	800	4,800	......	4,800	4	4	..	4	12
Ipswich, Mass	Boston, Mass	Sand	600	175	775	675	100	4	4	..	....	....
....	Fishing	....	6	....	6	6	......	2	1	1	1	1
Boston, Mass	Ipswich, Mass	....	600	....	600	....	600	4	4	..	....	....
....	Sailing excursion	....	150	....	150	150	....	8	8	..	....	....
....	....	....	77,056	16,983	94,039	24,504	69,535	121	102	19	59	96

ISLAND AND LONG ISLAND.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Charleston, S. C.	Yarmouth, Mass.	Phosph'te	16,000	3,400	19,400	....	19,400	8	8	..	....	....
Perth Amboy, N. J.	Boston, Mass	Coal	5,000	1,000	6,000	......	6,000	7	7	..	....	....
Musquash, N. B.	Philadelphia, Pa	Laths	4,500	3,750	8,250	6,675	1,575	5	5	..	....	....
Bu'nos Ayres, S. A.	Providence, R. I	Salt	3,000	1,200	4,200	....	4,200	9	9	..	....	....
Georgetown, D. C.	....do	Coal	30,000	3,000	33,000	....	33,000	7	7	..	7	14
Patchogue, N. Y.	Canarsie, L. I	....	600	....	600	600	......	8	8	..	8	3
East Harbor, Turk's Isl'd.	Boston, Mass	Salt	10,000	8,000	18,000	....	18,000	8	8	..	8	12
Cienfuegos, W. I.	New York	Sugar	10,000	1,000	11,000	11,000	....	10	10	..	4	4
New Orleans, La.	Providence, R. I	Cotton	14,000	60,000	74,000	40,000	34,000	6	6	..	6	30
Demerara, Br. Guiana.	New York	Sugar	16,000	35,000	51,000	9,000	42,000	11	11	..	7	14

DISTRICT No. 3.—COASTS OF RHODE

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1878. Jan. 8	Three-fourths mile northeast from Station.	1	Sc. Rachal Vanaman	Philadelphia, Pa ..	Carson	244
Jan. 21	One-half mile east of Station	15	Bark Fredrik	Mandab, Norway ..	Isaackson .	692
Feb. 23	Block Island Harbor	2	Sc. J. F. Dunton	New Bedford, Mass	Lumber ...	25
Mar. 24	Clam Pond Cove, Long Island.	22	Sc. Ann H. Hickman.	Philadelphia, Pa ..	Shaw	384
Mar. 28	Opposite Patchogue, N. Y	20	Ship Spartan	Boston, Mass	Jackson ...	1,449
Mar. 28	One and one-fourth miles west of Station.	8	S. S. Bengal*	London, England ..	Hutton	1,000
	Total	..	....	....	....	......

DISTRICT No. 4.—COAST

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877. Aug. 13	Brigantine Shoals	25	Str. Richmond †	New York	Kelly	2,000
Oct. 15	Cape May Point	40	Sc. H. A. Hunt ‡	Mauricetown, N. J.	Ross	339
Nov. 2	One-half mile south of Corson's Inlet.	32	Sc. Adeline Baxter ..	Philadelphia, Pa ..	Rodgers ...	55
Nov. 15 } Nov. 16 }	Cold Spring Bar	39	Sc. Florence	Cape May, N. J	Neal	32
Nov. 18	Absecom Bar	27	Sloop W. W. Wallace	Absecom, N. J	Summers ..	15
Nov. 24	North Bar, Hereford Inlet	35	Barque Johanna Lang	Brahestad, Finland	Bjorkgoist	530
Dec. 20	South Bar of Cold Spring	38	Sc. Northern Light ..	Cape May, N. J	McKean ..	19
1878. Jan. 2	South of Turtle Gut Inlet	38	Sc. C. H. Maleson § ..	Squan, N. J	Curtis	45
Jan. 6	Opposite station	22	Sc. Belle	Somer's Point, N. J	Read	......
Jan. 6	Brigantine Shoals	25	Sc. B. N. Hawkins ...	New York	Turpin	395
Jan. 7	One mile north of Station, Long Beach.	23	Sc. Sea Nymph	Providence, R. I ...	Laudican ..	175
Jan. 7	......do	23	Sc. James M. Vandervorse.	Perth Amboy, N. J	Brown	40
Jan. 23	Three-quarters of a mile southwest of Station, on inside bar.	23	Sc. Barnard	New York	Luker	143
Jan. 23	Southeast edge of Horse Shoe, Sandy Hook.	2	Sc. Eva Holmes	Forked River, N. J.	Bordan	66
Jan. 26	One-half mile above Station on Little Beach.	24	Sc. Twilight	Great Egg Harbor, N. J.	Parker	479
Jan. 28	One-half mile from Station on Long Branch, in Old Inlet.	23	Sc. Centennial	Tuckerton, N. J ...	Graham ...	8
Jan. 29	North Bar Turtle Gut Inlet ..	38	Sc. Denie Hastings ..	Great Egg Harbor, N. J.	Tilton	102
Jan. 30	North side Absecom Inlet	27	Sc. Annie S. Carll	Sayville, L. I	Seeman ...	75
Jan. 30	One-half mile south of Station, Little Egg Harbor Bar.	23	Sc. David Milliken ..	Philadelphia, Pa ...	Robinson ..	145
Jan. 31	Asbury Park, one-fourth mile south of Great Pond Inlet.	6	Brig Etta M. Tucker.	Portland, Me	Forbes	271
Jan. 31	One-half mile from Station ...	23	Sloop Ella May	Waretown, N. J ...	Wilkins ...	5
Feb. 10	On the bar abreast of Station .	7	Sc. Thomas G. Smith.	Philadelphia, Pa ...	Corson	283

* Got off next high tide without assistance. Value not ascertained. † Got off without damage.
‡ No assistance by station. § No assistance required.

ISLAND AND LONG ISLAND—Continued.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Boston, Mass.	New York		$8,000		$8,000	$1,000	$7,000	7	7		7	28
Leith, Scotland.	...do	Coal	23,000	$1,400	24,400		24,400	14	14		14	28
New Bedford, Mass.	Fishing		600	20	620		620	3	3		3	9
Philadelphia, Pa.	Portland, Me.	Railroad iron.	20,000	22,000	42,000		42,000	7	7			
Dublin, Ireland.	New York		80,000		80,000	80,000		31	31		31	93
Boston, Mass.	...do	Fruit						26	26			
			240,700	139,770	380,470	148,275	232,195	162	162		90	235

OF NEW JERSEY.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Lewistown, Del.	New York	Fruit	200,000		200,000	200,000		47	47			
Georgetown, D. C.	Providence, R. I	Soft coal	12,000	1,300	13,300	13,150	150	8	8			
Verplank Point, N. Y	Millville, N. J	Limest'ne	6,000	85	6,085	3,500	2,585	4	4			
Philadelphia, Pa.	Cape May, N. J	Stone coal	2,000	300	2,300		2,300	11	11		2	6
New York	Absecom, N. J	Coal	1,500	60	1,560	1,560		2	2			
Bordeaux, France.	Philadelphia, Pa	Ballast	10,000		10,000		10,000	17	17		17	17
Philadelphia, Pa.	Cape May, N. J	Coal	1,500	88	1,588	1,263	325	2	2			
Assawaman, Va.	New York	Pine wood	3,000	400	3,400	3,400		3	3			
New York	Somer's Point, N. J.		3,000		3,000	3,000		3	3			
Charleston, S. C.	New York	Lumber	20,000	3,000	23,000		23,000	10	10			
Richmond, Va.	Providence, R. I	Coal	3,000	825	3,825	3,795	30	5	5			
Virginia	New York	Pine wood	3,500	240	3,740	3,740		5	5			
New York	Chickahominy, Va.		5,000		5,000	5,000		6	6			
...do	Barnegat, N. J	Stone	2,000	80	2,080	1,860	220	3	3		3	3
			15,000		15,000		15,000	1	1			
Tuckerton, N. J.	Short Beach, N. J		75		75	75		2	2		2	8
New York	Norfolk, Va	Coal	3,000	350	3,350	2,350	1,000	5	5			
Rappahannock, Va.	New York	Oysters	4,000	900	4,900	4,900		5	5			
Baltimore, Md.	Brooklyn, N. Y	Coal	12,000	1,000	13,000	13,000		5	5			
Rio Janeiro, S. A.	New York	Coffee	9,000	80,000	89,000		89,000	8	8		7	28
Waretown, N. J.	Short Beach, N.J.		200	20	220	220		3	3		3	6
Georgetown, S. C.	New York	Rosin, tar, cotton, rice, spts. turpentine.	15,000	11,000	26,000	26,000		7	7		7	35

DISTRICT NO. 4.—COAST

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1878. Feb. 22	Wreck Pond Inlet, Squan Beach.	9	Sc. Maggie McDonnell.	Philadelphia, Pa	Steelman	138
Feb. 22	Deal Beach, at Sickles Pond	6	Sc. James R. Clements.	....do	Pearce	79
Feb. 22	Ocean Beach, one and one-half miles north of Station.	8	Sc. G. L. Bradley	Bucksport, Me	Chipman	179
Mar. 3	Eight miles off Cape May Light.	40	Sc. E. and L. Cordery	Great Egg Harbor, N. J.	Higbee	371
Mar. 3	Six hundred yards south of Station.	1	Sloop L. C. Wallace	Absecom, N. J	Somers	16
Mar. 23	Point of beach, north side Barnegat Inlet.	17	Sc. S. E. Barns	Staten Island	Osborn	46
Mar. 26	One mile south of Station, on "Sods."	23	Sc. Mary E. Simmons	Camden, N. J	mpbell	210
Mar. 26	Barnegat, one mile east-northeast of Station.	17	Sc. Mary Louisa	New York	Gaskell	99
May 6	One mile south of Station, Anchoring Island.	23	Sc. Alexander Wiley	Baltimore, Md	Beecher	60
May 26	Three-fourths of a mile east of Station.	17	Bark Othere	London, England	Wilson	647
May 30	Deal Beach, at Station	6	Sc. E. H. Atwood	Philadelphia, Pa	Gardner	259
June 1	Off Cape May	39	Sc. O. P. Binns	New York	Steelman	250
June 7	One mile north of Station	21	Sc. George Kilburn*.	Bangor, Me	Dodge	142
	Total					

DISTRICT NO. 5.—COASTS OF DELA-

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877. Sept. 8	Nine miles north of Station	3	Sc. Sydney Monsell †.	Patchogue (L. I.), N. Y.	Newton	48
Nov. 18	One mile east by south from Station, outer end Dawson Shoal.	5	Sc. James Anderson ‡	Wilmington, Del	Derrickson	89
Nov. 25	Opposite Station	8	Sc. Frank Jameson	Rockland, Me	Jameson	181
Nov. 25	Seven and one-half miles from Station.	4	Brig Ossipee	New York, N. Y	Haake	365
Dec. 1	One and one-half miles from Station outer shoal.	5	Sc. Jacob T. Alburgher.	Philadelphia, Pa	Newell	256
Dec. 9	One and three-quarter miles east-southeast from Station.	7	Sc. Winged Racer	Wellfleet, Mass	Hawes	80
1878. Jan. 3	Three and three-quarter miles north of Station.	3	Sc. Francis French	New York, N. Y	Gandy	119
Jan. 4	One and one-quarter miles southwest of Station.	4	Sc. Osborn Curtis	Perth Amboy, N. J.	Mount	48
Jan. 4	One-quarter of a mile north of Station.	3	Sc. Rebecca Knight	New York, N. Y	Leek	180
Jan. 4	South end Wreck Island	7	Sc. Montevue	New York, N. Y	....do	185
Jan. 6	One and one-quarter miles east-southeast of Station.	5	Sc. J. J. Spencer †	Boston, Mass	Haskell	210
Jan. 24	Southeast end of Carter's Shoals.	7	Bark West Wind §	Sligo, Ireland	Rider	332
Feb. 4	Three-quarters mile southeast Metompkin, Va.	5	B'kt'ne Jennie Sweeny.	Philadelphia, Pa	Hudson	643

*Abandoned at sea; no one on board when she struck.
† No assistance by station.
‡ Assistance rendered by passing schooners; none by station.
§ No assistance required of station.

OF NEW JERSEY—Continued.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Richmond, Va.	New York	Coal, powder, and staves.	$12,000	$6,000	$18,000	$1,000	$17,000	5	5	..	5	30
Maryland ...	Fair Haven, Conn	Oysters ..	4,500	1,300	5,800	....	5,800	5	5	..	5	10
Philadelphia, Pa.	Norwich, Conn ..	Coal	10,000	1,200	11,200	....	11,200	6	6	..	6	13
Richmond, Va.	Providence, R. I.	Coal	10,000	3,500	13,500	....	13,500	7	7	..	7	13
Absecom, N. J.	New York, N. Y.	Oysters and clams.	2,000	400	2,400	2,400	....	3	3	..	3	1
New York ..	Tom's River, N. J.	Lime	4,000	200	4,200	4,200	....	5	5	..	....	....
....do	Virginia	....	15,000	....	15,000	15,000	....	6	6	..	....	....
Washington, N. C.	New York	Tar, rosin, and cotton.	6,000	2,000	8,000	8,000	....	8	8	..	....	....
New Haven, Conn.	Baltimore, Md...	....	3,000	....	3,000	2,600	400	4	4	..	....	....
Havre, Fr'nce	Sandy Hook, N. J.	....	20,000	....	20,000	20,000	....	12	12	..	....	....
Philadelphia, Pa.	Providence, R. I.	Coal	4,000	1,200	5,200	....	5,200	6	6	..	6	12
Fredericksburg, Va.	New York	Railroad ties.	2,000	1,000	3,000	2,675	325	6	6	..	....	....
East Blue Hill, Me.	....do	Granite ..	5,000	5,500	10,500	....	10,500	9	9	..	....	....
			428,275	121,948	550,223	342,688	207,535	244	244	..	73	182

WARE, MARYLAND, AND VIRGINIA.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Watchapreague, Va.	New York, N. Y.	Sweet potatoes.	5,500	900	6,400	....	6,400	4	4	..	....	....
Philadelphia, Pa.	Norfolk, Va	Coal	1,500	300	1,800	....	1,800	3	3	..	....	....
Rockport, Me.	Richmond, Va...	Ice	8,000	500	8,500	....	8,500	6	1	5	1	6
Denia, Spain.	New York, N. Y.	Almonds and raisins.	14,000	30,000	44,000	1,000	43,000	9	7	2	....	....
Philadelphia, Pa.	Richmond, Va...	Pig-iron .	12,000	5,000	17,000	10,000	7,000	7	7	..	....	....
....do	Baltimore, Md...	Coal	2,400	400	2,800	....	2,800	6	6	..	6	28
Fredericksburg, Va.	New York, N. Y.	Tan-bark and oak lumber.	5,000	2,800	7,800	....	7,800	5	5	..	5	20
Assawaman, Va.	....do	Pine wood	4,000	300	4,300	3,800	500	4	4	..	4	8
James River, Va.	....do	..do	5,000	700	5,700	....	5,700	6	6	..	6	30
Virginia	....do	..do	3,000	600	3,600	....	3,600	7	7	..	7	21
Boston, Mass	Washington, D.C	Pitch and lumber.	6,000	3,000	9,000	....	9,000	19	‖ 19	..	1	1
Georgia......	Dublin, Ireland..	Pine timber.	13,000	15,000	28,000	28,000	....	10	10	..	....	....
Galveston, Tex.	Philadelphia, Pa.	Cotton...	30,000	130,000	160,000	158,000	2,000	11	11	..	....	....

‖ Thirteen belonged to recking crew.

DISTRICT No. 5.—COASTS OF DELAWARE,

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1878. Feb. 27	Nine miles west of Station, middle ground, Chesapeake Bay.	8	Sc. Mary A. Harmon*	Philadelphia, Pa..	Scaife.....	320
Mar. 7	Three-quarters mile south of Ragged Point Bluff.	4	St'ship North Point †	Kingston, Jamaica	Jones.....	455
Mar. 25	Two miles southeast of Station, Cheese Wreck Shoal.	5	Sc. Julius Webb.....	New York, N.Y..	Loveland..	134
Mar. 26	Off Cape Henlopen, Delaware.	1	Bktne. Mary Agnes ‡	Halifax, Nova Scotia.	De Costa..	343
May 15	Seven miles south Cape Henlopen, Delaware.	2	Sc. Sallie W. Kay....	Somer's Point, N.J.	Doughty..	377
	Total..................					......

DISTRICT No. 6.—COASTS OF

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877. Sept. 7	One mile from Station........	7	Small boat..........		Reed......	......
Sept. 11	Twelve miles north of Station.	6	Sc. Western Star §...	Boston, Mass......	Crocker...	318
Nov. 24	Two and one-quarter miles north of Station (Nags Head).	7	St'ship Huron......	United States Navy	George P. Ryan.	541
1878. Jan. 4	One-half mile north of Station.	1	Bk. Francisco Bellagamba. ‖	Genoa, Italy......	Brigwont.	430
Jan. 23	One and one-half miles south of Station.	3	Bk. Southern Belle..	Yarmouth, Nova Scotia.	Robbins...	582
Jan. 31	Four and one-half miles south of Station.	4	St'ship Metropolis..	New York, N.Y..	Ankers...	878
Feb. 9	Cape Henry..................	1	Bk. Guiseppe Messone.	Genoa, Italy......	Merble....	495
Mar. 28	Three miles north of Station.	3	Bktne. Nipote......	Fiume, Austria...	Dumick...	428
May 22	Opposite Cape Henry Light..	1	St'ship Antonia ‡...	Liverpool, England	Anderson.	......
	Total..................					......

DISTRICT No. 7.—COAST

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1878. Jan. 9	Seventeen miles north of Station.	3	Brig Providencia ¶..	Barcelona, Spain..	....	129
Feb. 17	Fowey Rock, Florida, fifteen miles south of Station.	5	St'ship Arratoon Apcar.**	London, England..	Pottinger.	1500
	Total..................					.....

* No assistance required of station.
† Station too remote to render assistance.
‖ No assistance rendered by station.
‡ Got off without assistance.
§ Sunk. Crew taken off by passing vessel.
¶ No assistance from station.
** Saved by wreckers.

MARYLAND, AND VIRGINIA—Continued.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days shelter afforded.
Baltimore, Md	Philadelphia, Pa	....	....	....	!	....	....	8	8	...	....	....
Kingston, Jamaica.	....do	Fruit, rags, and logwood.	$17,000	$5,000	$22,000	....	$22,000	20	20	...	....	....
New York ...	Virginia	....	2,000	....	2,000	$2,000	....	6	6	...	6	6
Cardenas, West Indies.	Delaware Breakwater.	Sugar....	15,000	46,400	61,400	61,400	....	9	9	...	....	....
Boston, Mass	Philadelphia, Pa	....	16,000	....	16,000	14,000	2,000	7	7	...	....	....
....	....	....	159,400	240,900	400,300	278,200	122,100	147	140	7	36	120

VIRGINIA AND NORTH CAROLINA.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days shelter afforded.
Kitty Hawk, N. C.	Manteo, N. C....	Fish	....	....	....	....	....	1	1	..	....	....
Georgetown, D. C.	Portsmouth, N. H	Coal	10,000	2,000	12,000	....	12,000	7	7	...	...	....
Hampton Roads, Va.	Key West, Fla..	....	408,692	....	408,692	....	408,692	132	34	98	30	30
Genoa, Italy.	Baltimore, Md ..	....	30,000	....	30,000	....	30,000	11	11	...	....	....
....do	....do.	Marble ..	14,000	25,000	39,000	28,000	11,000	19	19	...	....	....
Philadelphia, Pa.	Brazil, South America.	Railroad-iron, &c.	55,000	42,000	97,000	....	97,000	245	160	85	100	100
Belfast, Ireland.	Baltimore, Md ..	....	....	....	....	....	....	14	14	...	2	6
Fleetwood, England.	....do	....	....	....	....	....	....	10	10	..	....	....
Liverpool, England.	....do	....	....	....	....	....	....	27	27	...	....	....
....	....	....	517,692	69,000	586,692	28,000	558,692	466	283	183	132	136

OF FLORIDA.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days shelter afforded.
Carmen, Mexico.	Barcelona, Spain	Hides, cocoanuts, and logwood.	....	2,500	2,500	....	2,500	11	11	...	....	....
Liverpool, England.	Havana, Cuba...	Coal and iron.	90,000.	10,000	100,000	....	100,000	25	25	...	....	....
....	....	....	90,000	12,500	102,500	......	102,500	36	36	...	....	....

DISTRICT NO. 8.—COASTS

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
Sept. 1	South Channel	1	Sloop Maria	Oswego, N. Y	Turner	23
Sept. 6	Three-fourths miles N.W. from Station.	2	Mexico Belle (open boat).	Texas, N. Y	Tarr	......
Sept. 10	Mouth of Little Salmon Creek	2	Sc. Mary Davis	...do	Marsden	4
Sept. 28	On bar in mid-channel	1	Sc. Union	Big Sandy Creek, N. Y.	Ellis	25
Oct. 11	Near Grand River Pier	7	Sc. Curlew	Port Huron, Mich.	McCloud	80
Oct. 14	On bar in mid-channel	1	Sc. Union	Big Sandy Creek, N. Y.	Ellis	25
Oct. 21	Four miles N. of Station	9	Sc. Clipper Vision	Port Huron, Mich.	....	37
Oct. 21	On Sand Shoal, S. of channel	6	Sc. E. P. Beals	Buffalo, N. Y	Collin	375
Nov. 3	Near Hamburgh, ten miles from Buffalo.	5	Brig E. Cohen	Oswego, N. Y	Goldin	205
Nov. 3	One-half mile from Buffalo	5	Fish-boat	Buffalo, N. Y	O'Brien	......
Nov. 5	Four miles W. of Charlotte	4	Sc. Delos De Wolf	Oswego, N. Y	Pitcher	299
Nov. 10	Old pier entrance of Port Ontario.	2	Sc. Mist	...do	Hinman	85
Nov. 14	On bar in mid-channel	1	Sc. Union	Big Sandy Creek, N. Y.	Ellis	25
Nov. 21	Mouth Little Salmon Creek	2	Sc. Mary Davis	Texas, N. Y	Marsden	4
Nov. 27	Seven miles E. of Station	6	Tug Thos. Thompson	Erie, Pa	Mahoney	19
Nov. 30	Twelve miles E. of Charlotte	4	Sc. L. L. Lamb	Detroit, Mich	Whipple	253
Dec. 6	East pier at Oswego	3	Sc. Wayne	Oswego, N. Y	Atkinson	332
1878.						
Apr. 9	N. E. point of Presque Isle	6	Sc. John L. Shaffer	Erie, Pa	Hunn	5
Apr. 9	N. E. point of Peninsula	6	Dexter (fishing boat)	...do	Jones	......
May 19	Off Cleveland	8	Star (fish-boat)	Cleveland, O	Tonat	......
May 20	Entrance of harbor	6	Open boat	....	Cameron	......
May 31	Between Oswego and Galoocs.	1	St. barge Portsmouth	Kingston, Canada.	Easton	152
June 4	East Pier, Cleveland	8	Sc. H. D. Root	Fremont, O	Chilson	117
June 4	Off Erie, Pa	6	Open boat	Erie, Pa	....	......
	Total	..	....	....	....	......

DISTRICT NO. 9.—COASTS

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
Sept. 28	White Fish Point, ten miles from station.	6	St. J. K. White	Marquette, Mich	Lang	50
Oct. 10	Four miles S. W. from North Point.	4	Sc. J. B. Kitchen	Cleveland, O	Herington	287
Oct. 10	One mile due S. of North Point	4	Sc. Lake Forest	Chicago, Ill	Nelson	432
Oct. 11	One mile W. of Port Austin	1	Br. Sc. Abeona	Michael Bay, Canada.	McCauley	100
Nov. 8	One mile S. of North Point reef.	4	Sc. Empire State	Cleveland, O	McHenry	318
Nov. 8	Burnt Cabin Point Reef	1	Sc. Berlin	Marblehead, O	Johnston	213
Nov. 9	East side North Point Reef	4	Bark Sunny Side	Detroit, Mich	Bell	563
Dec. 12	S. E. corner Outer Reef, Black River.	3	Sc. Monterey	...do	Merrick	308
	Total	..	....	....	....	......

OF LAKES ERIE AND ONTARIO.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Thousand Islands.	Oswego, N. Y...	Ballast ..	$2,000	....	$2,000	$2,000	....	3	3	..	....	....
Texas, N. Y.	Pleasure trip....	....	40	....	40	40	....	4	4	..	....	....
Oswego, N. Y.	Texas, N. Y	Peaches .	200	$50	250	250	....	2	2	..	....	....
Canada......	Big Sandy Creek, N. Y.	Lumber .	1,500	800	2,300	2,300	....	3	3	..	....	....
Port Hope, Mich.	Cleveland, O	Laths, and pine lumber.	3,000	900	3,900	3,500	$400	4	4	..	....	....
Oswego, N. Y.	Big Sandy Creek, N. Y.	Coal and nails.	1,500	382	1,882	1,882	....	3	3	..	....	....
Port Huron, Mich.	Cleveland, O	Shooks ..	600	800	1,400	900	500	3	3	..	....	....
Erie, Pa.....	Chicago, Ill	Coal	20,000	2,100	22,100	16,700	5,400	8	8	..	....	....
Toledo, O....	Buffalo, N. Y	Corn.....	8,000	6,500	14,500	4,000	10,500	7	7	..	....	....
Buffalo, N. Y.	....	....	50	....	50	....	50	2	2	..	....	....
Ogdensburg, N. Y.	Cleveland, O	Iron ore.	12,000	2,200	14,200	10,200	4,000	8	8	..	....	....
Chamont....	Port Ontario, N. Y.	Cut limestone.	1,000	25	1,025	985	40	3	3	..	....	....
Oswego, N. Y.	Big Sandy Creek, N. Y.	Coal and kerosene oil.	1,500	400	1,900	1,900	....	3	3	..	....	....
Kingston....	Texas, N. Y	Cedar wood.	200	12	212	187	25	2	2	..	....	....
Erie, Pa.....	Cruising	....	7,200	....	7,200	....	7,200	8	8	..	....	....
Detroit......	Oswego, N. Y....	Wheat...	5,000	20,000	25,000	25,000	....	8	8	..	....	....
Milwaukee, Wis.	....do	..do......	12,000	23,000	35,000	....	35,000	8	8	..	....	....
Erie, Pa.....	Fishing	Fish	300	300	600	500	100	2	2	..	2	4
.. do	....do	..do......	500	500	1,000	1,000	....	3	3	..	3	3
Cleveland, O	Fishing	....	30	....	30	30	....	4	4	..	....	....
Collingwood, O.	Port Colborne, Canada.	....	20	50	70	70	....	1	1	..	1	1
Oswego, N. Y.	Kingston, Canada	....	5,000	....	5,000	5,000	......	10	10	..	....	....
Fremont, O..	Cleveland, O	....	2,500	....	2,500	2,400	100	6	6	..	....	....
Erie, Pa.....	Fishing	....	50	....	50	30	20	2	2	..	2	1
....	....	....	84,190	58,019	142,209	78,874	63,335	102	102	..	8	9

OF LAKES HURON AND SUPERIOR.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Sault Ste. Marie, Mich.	Marquette, Mich	....	2,500	....	2,500	2,450	50	3	3	..	....	....
Fayette, Mich.	Cleveland, O	Pig-iron .	18,000	15,574	33,574	32,574	1,000	8	8	..	....	....
Buffalo, N. Y	Chicago, Ill	Coal	12,500	2,000	14,500	11,500	3,000	10	9	*1	....	....
Michael Bay, Canada.	Sarnia (Island Guernsey).	Lumber and shingles.	2,000	400	2,400	200	2,200	4	4	..	....	....
Marquette, Mich.	Cleveland, O	Iron ore..	8,000	2,850	10,850	....	10,850	8	8	..	....	....
Marblehead, O.	Bay City, Mich..	Limestone.	6,000	300	6,300	....	6,300	6	2	4	2	2
Buffalo, N. Y.	Chicago, Ill	Hard coal	25,000	5,700	30,700	26,500	4,200	10	10	..	....	....
Muskegon, Mich.	Ogdensburg, N. Y.	Lumber .	8,000	5,500	13,500	7,000	6,500	8	8	..	7	7
....	....	....	82,000	32,324	114,324	80,224	34,100	57	52	5	9	9

* Killed by fore-boom.

DISTRICT No. 10.—COAST

Date.	Place.	No. of station.	Name of vessel.	Where owned.	Master.	Tonnage.
1877.						
Oct. 10	Near South Pier, 100 yards south.	6	Sc. D. G. Williams...	Marysville, Mich..	Budget....	118
Nov. 5	Two and a half miles north of North Pier, Chicago.	8	Sc. F. B. Gardner* ...	Chicago, Ill	Gibbs	422
Nov. 9	Off Two Rivers	12	Sc. Magellan	St. Catherine's, Canada.	Belger	350
Nov. 10	Five miles north of Waukegan, Lake Michigan.	9	Sc. Two Katies.......	Racine, Wis........	Doat	74
1878.						
Mar. 23	Three miles west of Station..	4	Fish-boat	Ludington	....	......
Mar. 24	Two miles from Station, southeast side of Round-House.	7	Sc. Minnie Corlett...	Grand Haven, Mich.	Burnmeister.	107
June 21	Half mile south of harbor....	6	Sc. Sandy Morrison..	Grand Haven, Mich.	Downie ...	39
	Total		....	....	....	......

*No assistance by station.

RECAPITU

	Total number of vessels driven ashore.	Total value of vessels.	Total value of cargoes.
District No. 1	32	$163, 450	$41, 778
District No. 2	20	77, 056	16, 983
District No. 3	16	240, 700	139, 770
District No. 4	35	428, 275	121, 948
District No. 5	18	159, 400	240, 900
District No. 6	9	517, 692	69, 000
District No. 7	2	90, 000	12, 500
District No. 8	24	84, 190	58, 019
District No. 9	8	82, 000	32, 324
District No. 10	7	36, 300	12, 450
District No. 11	......	......	......
Aggregate	171	1, 879, 063	745, 672

OF LAKE MICHIGAN.

Where from.	Where bound.	Cargo.	Estimated value of vessel.	Estimated value of cargo.	Total.	Estimated amount saved.	Estimated amount lost.	No. of persons on board.	No. of persons saved.	No. of persons lost.	No. of persons sheltered at stations.	No. of days' shelter afforded.
Muskegon ..	Chicago, Ill......	Lumber .	$4,000	$1,550	$5,550	....	$5,550	6	6	..	....	...
Chicago, Ill..	Duncan City, Mich.	....	9,000	....	9,000	$6,000	3,000	8	8	..	....	...
Chicago, Ill..	Toronto, Canada	Corn	17,000	10,000	27,000	....	27,000	8	....	8	....	...
Frankfort ..	Racine, Wis.....	Lumber, bass-wood.	1,500	900	2,400	2,100	300	4	4	..	....	...
Ludington ..	Fishing	....	300	....	300	....	300	2	1	1	....	...
Chicago, Ill ..	Pentwater	....	2,500	....	2,500	......	2,500	5	4	1	....	...
Milwaukee, Wis.	Grand Haven, Mich.	....	2,000	....	2,000	1,500	500	4	4	..	4	14
....	....	....	36,300	12,450	48,750	9,600	39,150	37	27	10	4	14

LATIÓN.

Total amount of property imperiled.	Total amount of property saved.	Total amount of property lost.	Total number of lives imperiled.	Total number of lives saved.	Total number of lives lost.	Total number of shipwrecked persons sheltered at stations.	Total number of days' shelter afforded.	Number of disasters involving total loss of vessel and cargo.
$205,228	$107,010	$98,218	185	183	2	12	48	7
94,039	24,504	69,535	121	102	19	59	96	10
380,470	148,275	232,195	162	162	....	90	235	8
550,228	342,688	207,535	244	244	....	73	182	10
400,300	278,200	122,100	147	140	7	36	120	9
586,692	28,000	558,692	466	283	183	132	136	4
102,500	....	102,500	36	36	....	....	....	2
142,209	78,874	63,335	102	102	....	8	9	3
114,324	80,224	34,100	57	52	5	9	9	2
48,750	9,600	39,150	37	27	10	4	14	4
....	....	....	....	....	....	....	....	....
2,624,735	1,097,375	1,527,360	1,557	1,331	226	423	849	59

LIST OF LIFE-SAVING DISTRICTS AND STATIONS

ON THE

COASTS OF THE UNITED STATES.

(ON AND AFTER DECEMBER 10, 1878.)

9 L S

LIFE-SAVING DISTRICTS AND STATIONS ON THE COASTS OF THE UNITED STATES.

FIRST DISTRICT.

EMBRACING COASTS OF MAINE AND NEW HAMPSHIRE.

No.	Name.	State.	Locality.	Approximate position. Latitude, north.	Approximate position. Longitude, west.
				° ′ ″	° ′ ″
1	West Quoddy Head	Me	Eastport Bay	44 48 25	66 58 25
2	Cross Island	Me	Off Machiasport	44 37 28	67 16 20
3	Browney's Island	Me	Off Jonesborough	44 28 30	67 37 00
4	Little Cranberry Island	Me	Station not yet built		
5	Whitehead Island	Me	Near Whitehead Light	43 58 41	69 07 37
6	Biddeford Pool	Me	Fletcher's Neck	43 26 32	70 20 08
7	Straw's Point	N. H	Rye Beach	42 59 31	70 45 00

SECOND DISTRICT.

EMBRACING COAST OF MASSACHUSETTS.

1	Plum Island	Mass	Near Newburyport, 3 miles distant	42 47 05	70 48 41
2	Davis Neck	Mass	Near Annisquam light	42 40 03	70 40 03
3	Scituate	Mass	Station not yet built		
4	Gurnett's	Mass	8 miles northeast of Plymouth	42 00 10	70 35 50
5	Manomet Point	Mass	7 miles southeast of Plymouth	41 55 29	70 32 18
6	Race Point	Mass	⅜ mile northeast of Race Point light, Cape Cod.	42 04 12	70 13 58
7	Peaked Hill Bar	Mass	2½ miles northeast of Provincetown, Cape Cod.	42 04 34	70 08 54
8	Highlands	Mass	¼ mile northwest of light, Cape Cod	42 02 47	70 04 05
9	Parmet River	Mass	3¼ miles south of Highlands light	41 59 59	70 00 53
10	Cahoon's Hollow	Mass	2½ miles east of the town of Wellfleet	41 56 38	69 58 40
11	Nausett	Mass	1¾ miles south of lights	41 50 29	69 56 20
12	Orleans	Mass	Abreast of Ponchet Island	41 45 31	69 55 31
13	Chatham	Mass	1¼ miles south of Chatham light	41 38 57	69 56 34
14	Monomoy	Mass	2 miles north of Monomoy light	41 36 00	69 58 41
15	Surfside	Mass	2½ miles south of the town of Nantucket	41 14 33	70 08 36

THIRD DISTRICT.

EMBRACING COASTS OF RHODE ISLAND AND LONG ISLAND.

1	Narragansett Pier	R. I	Northern part of the town	41 25 59	71 27 04
2	Point Judith	R. I	Southern extremity of Narragansett	41 21 38	71 28 54
3	Watch Hill	R. I	Near light-house; station not yet built		
4	New Shoreham	R. I	Block Island, east side, near landing	41 10 30	71 33 07
5	Block Island	R. I	Block Island, west side, near Dickens's Point.	41 09 41	71 36 13
6	Móntauk Point	N. Y	At the light	41 04 07	71 51 00
7	Ditch Plain	N. Y	3 miles southwest of Montauk light	41 02 19	71 54 38
8	Hither Plain	N. Y	½ mile southwest of Fort Pond	41 01 33	71 57 26
9	Napeague	N. Y	Abreast of Napeague Harbor	40 59 38	72 02 24
10	Amagansett	N. Y	Abreast of the town	40 58 05	72 07 24
11	Georgica	N. Y	1 mile south of East Hampton	40 56 35	72 11 19
12	Bridgehampton	N. Y	2 miles south of town	40 54 06	72 17 41
13	Southampton	N. Y	¾ mile south of town	40 52 13	72 23 07
14	Shinnecock	N. Y	3 miles from the head of Shinnecock Bay	40 50 40	72 27 30
15	Tyana	N. Y	4 miles east of Quogue	40 49 36	72 31 16
16	Quogue	N. Y	½ mile south of the village	40 48 23	72 35 41
17	Tanner's Point	N. Y	1½ miles southwest of Patunk village	40 47 52	72 39 01

Life-saving districts and stations on coasts of United States—Continued.

THIRD DISTRICT—Continued.

No.	Name.	State.	Locality.	Approximate position. Latitude, north. ° ′ ″	Longitude, west. ° ′ ″
18	Moriches	N. Y.	2½ miles southwest of Speonk village	40 46 25	72 42 49
19	Forge River	N. Y.	3½ miles south of Moriches	40 44 56	72 48 12
20	Smith's Point	N. Y.	Abreast of the point	40 43 51	72 52 20
21	Bellport	N. Y.	4 miles south of the village	40 42 42	72 55 46
22	Blue Point	N. Y.	4½ miles south of Patchogue	40 40 40	73 01 15
23	Lone Hill	N. Y.	4½ miles south of Sayville	40 39 46	73 04 27
24	Point of Woods	N. Y.	5 miles south of Islip	40 38 55	73 08 11
25	Fire Island	N. Y.	East side Fire Island Inlet	40 37 34	73 13 36
26	Oak Island, east end	N. Y.		40 38 15	73 17 39
27	Oak Island, west end	N. Y.		40 37 16	73 22 24
28	Jones's Beach, east end	N. Y.		40 36 27	73 25 20
29	Jones's Beach, west end	N. Y.	6 miles south of South Oyster Bay	40 36 10	73 28 43
30	Short Beach	N. Y.	½ mile east of Jones's Inlet	Not determined.	
31	Meadow Island	N. Y.	Entrance of Jones's Inlet	40 35 55	73 33 41
32	Long Beach, east end	N. Y.	2 miles west of Jones's Inlet	40 35 18	73 35 47
33	Long Beach, west end	N. Y.	Near Lucy's Inlet	40 35 03	73 39 09
34	Hog Island, west end	N. Y.	Near Hog Island Inlet	40 35 22	73 43 50
35	Rockaway Beach	N. Y.	Near the village of Rockaway	40 35 25	73 46 55
36	Rockaway Beach	N. Y.	West end	40 34 15	73 51 08
37	Coney Island	N. Y.	Manhattan Beach	40 34 21	73 56 06
38	Eaton's Neck	N. Y.	East side entrance to Huntington Bay, Long Island Sound.	40 57 12	73 23 45

FOURTH DISTRICT.

EMBRACING COAST OF NEW JERSEY.

No.	Name.	State.	Locality.	Latitude, north.	Longitude, west.
1	Sandy Hook	N. J.	383 yards east of main light	40 27 42	73 59 34
2	Spermaceti Cove	N. J.	East of the upper end of Cove	40 25 39	73 58 50
3	Seabright	N. J.	About a mile south of Highlands Station	40 22 46	73 58 11
4	Monmouth Beach	N. J.	3½ miles south of Highlands Station	40 20 30	73 58 07
5	Long Branch	N. J.	Near Green's Pond	40 16 36	73 58 43
6	Deal Beach	N. J.	Near the town, 328 yards north of Great Pond.	40 14 00	73 59 29
7	Shark River	N. J.	Near the mouth of Shark River	40 11 25	74 00 19
8	Wreck Pond	N. J.	2½ miles below Shark River	40 09 20	74 00 56
9	Squan Beach	N. J.	1 mile southeast of Squan Village	40 06 52	74 01 43
10	Point Pleasant	N. J.	At the head of Barnegat Bay	40 03 58	74 02 20
11	Squan Point	N. J.	2½ miles below the head of Barnegat Bay	40 01 37	74 03 15
12	Green Island	N. J.	5 miles below the head of Barnegat Bay	39 59 06	74 03 33
13	Tom's River	N. J.	On the beach abreast of its mouth	39 56 15	74 04 30
14	Island Beach	N. J.		39 53 42	74 04 57
15	Forked River	N. J.		39 51 06	74 05 16
16	South end Island Beach	N. J.	North side of the inlet	39 48 08	74 05 40
17	Barnegat	N. J.	South side of the inlet	39 45 34	74 06 12
18	Loveladies Island	N. J.	On the beach abreast of the island	39 43 47	74 07 01
19	Harvey Cedars	N. J.		39 40 23	74 08 13
20	Ship Bottom	N. J.		39 38 13	74 10 42
21	Long Beach	N. J.		39 35 03	74 13 03
22	Bond's	N. J.		39 31 59	74 15 16
23	Little Egg	N. J.	Near the light north of inlet	39 30 05	74 17 28
24	Little Beach	N. J.	South side of Little Egg Inlet	39 27 23	74 19 28
25	Brigantine	N. J.	5½ miles above Absecom light	39 25 23	74 20 02
26	S. Brigantine	N. J.	2 miles above Absecom light	39 23 20	74 23 08
27	Atlantic City	N. J.	Near Absecom light	39 21 57	74 24 31
28	Absecom	N. J.	3 miles below the light	39 20 45	74 27 27
29	Great Egg	N. J.	6 miles below the light	39 19 02	74 30 51
30	Beazleys	N. J.	South side of the inlet	39 17 10	74 34 30
31	Peck's Beach	N. J.	3½ miles above Corson's Inlet	39 14 47	74 36 29
32	Corson's Inlet	N. J.	Near the inlet, north side	39 12 59	74 38 06
33	Ludlam's Beach	N. J.	3½ miles above Townsend's Inlet	39 09 42	74 40 41
34	Townsend's Inlet	N. J.	Near the inlet, north side	39 07 30	74 42 21
35	Stone Harbor	N. J.	3½ miles above Hereford Inlet	39 03 35	74 44 50
36	Hereford Inlet	N. J.	Near Hereford light	39 00 14	74 46 55
37	Turtle Gut	N. J.	6 miles above Cape Island City	38 58 39	74 50 34
38	Two-Mile Beach	N. J.	4 miles above Cape Island City	38 57 08	74 51 00
39	Cape May	N. J.	2 miles above Cape Island City	38 56 01	74 54 00
40	Cape May	N. J.	Near the light	38 55 50	74 57 36
41	Bay Shore	N. J.	2½ miles west of Cape Island City	38 56 37	74 58 03

Life-saving districts and stations on coasts of United States—Continued.

FIFTH DISTRICT.

EMBRACING COAST BETWEEN CAPE HENLOPEN AND CAPE CHARLES.

No.	Name.	State.	Locality.	Approximate position. Latitude, north.	Longitude, west.
				° ′ ″	° ′ ″
1	Cape Henlopen	Del		38 46 38	75 04 43
2	Rehoboth Beach	Del		Not determined.	
3	Indian River Inlet	Del		38 36 40	75 04 30
4	Ocean City	Md	Just north of town	Not determined.	
5	Green Run Inlet	Md		38 03 15	75 13 15
6	Pope's Island	Md		Not determined.	
7	Assateague Beach	Va	Abreast of Assateague light	37 54 10	75 19 35
8	Cedar Inlet	Va	South end of Cedar Island	37 35 10	75 36 20
9	Hog Island	Va	South end of Hog Island	37 26 45	75 41 00
10	Cobb's Island	Va	South end of Cobb's Island	37 17 20	75 46 15
11	Smith's Island	Va	South end of Smith's Island	37 06 20	75 55 00

SIXTH DISTRICT.

EMBRACING COAST BETWEEN CAPE HENRY AND CAPE FEAR.

No.	Name.	State.	Locality.	Latitude, north.	Longitude, west.
1	Cape Henry	Va		36 55 30	76 00 30
2	Seatack	Va		Not determined.	
3	Dam Neck Mills	Va		Do.	
4	Little Island	Va		Do.	
5	False Cape	Va		36 38 15	75 53 00
6	Deal's Island	N. C		Not determined.	
7	Old Currituck Inlet	N. C		Do.	
8	Jones's Hill	N. C	Currituck Beach	36 22 00	75 49 00
9	Poyner's Hill	N. C		Not determined.	
10	Caffrey's Inlet	N. C		Do.	
11	Paul Gamiel's Hill	N. C		Do.	
12	Kitty Hawk	N. C		Do.	
13	Kill Devil Hills	N. C		Do.	
14	Nag's Head	N. C	8 miles north of Oregon Inlet	35 55 30	75 36 15
15	Tommy's Hummock	N. C		Not determined.	
16	Bodie's Island	N. C	½ mile south of Oregon Inlet	35 47 30	75 32 00
17	Pea Island	N. C		Not determined.	
18	Chicamicomico	N. C	5 miles south of New Inlet	35 35 30	75 27 30
19	Cedar Hummock	N. C		Not determined.	
20	Little Kinnakeet	N. C		35 24 30	75 28 30
21	Big Kinnakeet	N. C	6 miles north of Cape Hatteras light-house.	Not determined.	
22	Creed's Hill	N. C	4½ miles west of Cape Hatteras light-house.	Do.	
23	Hatteras	N. C	3 miles east of Hatteras Inlet	Do.	
24	Cape Lookout	N. C	Station not yet built		
25	Cape Fear	N. C	......do		

SEVENTH DISTRICT.

EASTERN COAST OF FLORIDA.

No.	Name.	State.	Locality.	Latitude, north.	Longitude, west.
1	Thirteen miles north of Indian River Inlet.	Fla		Not determined.	
2	Gilbert's Bar	Fla	Saint Lucie Rocks	Do.	
3	Orange Grove	Fla		Do.	
4	Fort Lauderdale	Fla		Do.	
5	Biscayne Bay	Fla		Do.	

EIGHTH DISTRICT.

EMBRACING GULF-COAST OF UNITED STATES.

No.	Name.	State.	Locality.
1	Sabine Pass	Texas.	Station not yet built.
2	Galveston, east end of island	Texas	Do.
3	Galveston, west end of island	Texas.	Do.
4	Pass Cavallo	Texas	Do.
5	Aranzas Pass	Texas.	Do.
6	Brazos Santiago	Texas.	Do.

Life-saving districts and stations on coasts of United States—Continued.

NINTH DISTRICT.

EMBRACING LAKES ERIE AND ONTARIO.

No.	Name.	State.	Locality.
1	Big Sandy Creek	N. Y.	East side of mouth of Big Sandy Creek, Lake Ontario.
2	Salmon Creek	N. Y.	East side of mouth of Salmon Creek, Lake Ontario.
3	Oswego	N. Y.	Entrance of Oswego Harbor, Lake Ontario.
4	Charlotte	N. Y.	Entrance of Charlotte Harbor, Lake Ontario.
5	Buffalo	N. Y.	Entrance of Buffalo Harbor, Lake Erie.
6	Presque Isle	Pa	Entrance of Erie Harbor, Lake Erie.
7	Fairport	Ohio	Entrance of Fairport Harbor, Lake Erie.
8	Cleveland	Ohio	Entrance of Cleveland Harbor, Lake Erie.
9	Marblehead Point	Ohio	Marblehead Island, near Quarry Docks, Lake Erie.

TENTH DISTRICT.

EMBRACING LAKES HURON AND SUPERIOR.

No.	Name.	State.	Locality.
1	Sand Beach Harbor	Mich	Lake Huron. Station not yet built.
2	Point aux Barques	Mich	Near light-house, Lake Huron.
3	Port Austin	Mich	Lake Huron. Station not yet built.
4	Ottawa Point (Tawas)	Mich	Near light-house, Lake Huron.
5	Sturgeon Point	Mich	Do.
6	Thunder Bay Island	Mich	Do.
7	Middle Island	Mich	Lake Huron. Station not yet built.
8	Forty-Mile Point	Mich	Hammond's Bay, Lake Huron.
9	Vermillion Point	Mich	Lake Superior.
10	Seven miles west of Vermillion Point.	Mich	Do.
11	Two Heart River	Mich	Near mouth of Two Heart River, Lake Superior.
12	Sucker River	Mich	Near mouth of Sucker River, Lake Superior.
13	Ship Canal	Mich	Near mouth of Portage Lake and Lake Superior Ship Canal, Lake Superior. Station not yet built.

ELEVENTH DISTRICT.

LAKE MICHIGAN.

No.	Name.	State.	Locality.
1	Beaver Island	Mich	Near light-house.
2	North Manitou Island	Mich	Near Pickard's wharf.
3	Sleeping Bear Point	Mich	Station not yet built.
4	Point au Bec Scies	Mich	Near light-house.
5	Manistee	Mich	Station not yet built.
6	Grand Point au Sauble	Mich	Near light-house.
7	Ludington	Mich	Station not yet built.
8	Muskegon	Mich	Do.
9	Grand Haven	Mich	Entrance of harbor.
10	Saint Joseph	Mich	In the harbor.
11	Chicago	Ill	Do.
12	Grosse Point	Ill	Evanston, Ill., on Northwestern University grounds.
13	Kenosha	Wis	Station not yet built.
14	Racine	Wis	In the harbor.
15	Milwaukee	Wis	Near entrance of harbor.
16	Sheboygan	Wis	Entrance of harbor.
17	Two Rivers	Wis	Do.
18	Bayley's Harbor	Wis	Station not yet built.

TWELFTH DISTICT.

PACIFIC COAST.

No.	Name.	State.	Locality.
1	Neah Bay	W. T.	On Indian reservation.
2	Shoalwater Bay	W. T.	Near light-house boat-landing.
3	Cape Disappointment	W. T.	Baker's Bay.
4	Cape Arago	Oreg.	Coos Bay, near light-house.
5	Humboldt Bay	Cal	Near light-house.
6	Bolinas Bay	Cal	Station not yet built.
7	Golden Gate Park	Cal	On beach in Golden Gate Park, San Francisco.
8	Point Concepcion	Cal	Station not yet built.

ABSTRACTS

OF RETURNS OF

WRECKS AND CASUALTIES TO VESSELS

WHICH HAVE OCCURRED ON AND NEAR THE

COASTS AND ON THE RIVERS OF THE UNITED STATES,

AND TO

AMERICAN VESSELS AT SEA AND ON THE COASTS OF FOREIGN COUNTRIES,

DURING THE

FISCAL YEAR ENDING JUNE 30, 1878.

WRECKS, CASUALTIES, AND COLLISIONS AT HOME AND ABROAD.

REMARKS EXPLANATORY OF THE WRECK-STATISTICS FOR THE YEAR 1877–'78.

The following is the fifth annual statement of wrecks and casualties which have occurred on or near the coasts and on the rivers of the United States, and to American vessels at sea or on the coasts of foreign countries.

The statistics relating to disasters upon our own coast are compiled from reports obtained and received through the officers of the customs, in compliance with the acts of June 20, 1874, and June 18, 1878.

Those relating to disasters which have occurred to American shipping in foreign waters are derived from reports received from our consular officers abroad and through the courtesy of officers of foreign governments, an interchange of such information having been effected, through the Department of State, with most other maritime nations.

In the preparation of the accompanying tables, it has been found advisable, in order to facilitate reference, to make the following general divisions:

I. Disasters occurring on the Atlantic and Gulf coasts of the United States, embracing—

1. All casualties outside of, but in proximity to, the coast line;
2. All casualties occurring in the bays and harbors adjacent to the coasts named;
3. All casualties occurring in or near the mouths of rivers emptying into the ocean or gulf.

II. Disasters occurring upon the Pacific coast of the United States, including those occurring in adjacent waters, as in the first division.

III. Disasters occurring on the great lakes, embracing—

1. All casualties occurring on Lakes Superior, Michigan, Huron, Saint Clair, Erie, or Ontario, reported by officers of the customs, whether in waters under the jurisdiction of the United States or of Great Britain;
2. All casualties occurring in the rivers, straits, &c., connecting the several lakes named;
3. All casualties occurring in the harbors of any of said lakes, or in or near the mouths of rivers emptying into them, within the United States.

IV. Disasters occurring in rivers within the United States, embracing all rivers except those referred to in the foregoing division.

V. Disasters occurring to American shipping at sea or in foreign waters.

The disasters embraced in the foregoing divisions are classified as follows, viz:

1. *Founderings*—embracing founderings which resulted from the leaking or capsizing of vessels, but not those which resulted from collision, stranding, or striking any sunken wreck, or against piers, snags, or ice.
2. *Strandings*—embracing disasters resulting from running aground,

striking a rock, reef, bar, or other natural object, although the vessel may have foundered as a result of such casualty.

3. *Collisions*—embracing all collisions between vessels only.

4. *Other causes*—embracing disasters resulting from various causes, as follows, viz:

Fire, irrespective of result;

Scuttling, or any intentional damage to vessel;

Collisions with fields or quantities of ice, although vessel may be sunk thereby;

Striking on sunken wrecks, anchors, buoys, piers, or bridges;

Leakage (except when vessel foundered or went ashore for safety;)

Loss of masts, sails, boats, or any portion of vessel's equipments;

Capsizing, when vessel did not sink;

Damage to machinery;

Fouling of anchors;

Striking of lightning;

Explosion of boilers;

Breakage of wheels;

Also water-logged, missing, and abandoned vessels.

Since the publication of the annual statement for the fiscal year ending June 30, 1877, information has been received of the occurrence of disasters during that year to 39 American vessels. The localities and nature of these casualties were as follows:

On the Atlantic and Gulf coasts, eight, viz: One by foundering; three by stranding; one by collision; and three from other causes. Of these, one foundering and two strandings resulted in total loss.

On the Pacific coast, three, viz: Two by stranding, and one from other causes.

On the great lakes, nine, viz: Five by stranding, one by collision, and three from other causes; one of the strandings resulting in total loss.

On the rivers, four from other causes, two resulting in total loss.

At sea or in foreign waters, fifteen, viz: One by foundering, two by stranding, one by collision, and eleven from other causes. Of these, one foundering, one stranding, and three disasters from other causes resulted in total loss.

The additional loss of forty-two lives has been reported since the publication of the last annual statement, as follows: Two vessels having crews of eight and fourteen persons, respectively, were never heard from; supposed to have foundered. One with a crew of ten persons went down on her passage from Saint John, N. B., to Liverpool; one man fell overboard from a vessel; one was washed overboard in a gale; two were lost in a severe storm; one was killed by the bursting of a steam-pipe, and five persons were otherwise lost from vessels sustaining no damage. Of the above losses, two occurred on the Atlantic coast, one on the Pacific coast, one on the great lakes, one on the rivers, and thirty-seven at sea or in foreign waters.

As the foregoing could not properly be included in the report for the fiscal year just closed, it is thought advisable to reprint the general summary table of the previous year, amended so as to include the particulars furnished by the wreck-reports mentioned above. The table will be convenient for the purpose of comparison with the corresponding table in the statement of the present year, and is accordingly herewith presented.

SUMMARY of disasters to vessels which occurred on and near the coasts and on the rivers of the United States, and to American vessels at sea and on the coasts of foreign countries, during the fiscal year ending June 30, 1877.

Nature of casualties.	Number of vessels.	Aggregate tonnage.	Wrecks involving total loss.	Casualties involving partial damage.	Number of lives lost.
Founderings:					
Atlantic and Gulf coasts	42	3, 563. 78	30	12	27
Pacific coast					
Great lakes	12	3, 020. 31	10	2	9
Rivers	8	660. 63	2	6	
At sea or in foreign waters	43	13, 183. 18	43		77
Total	105	20, 427. 90	85	20	113
Strandings:					
Atlantic and Gulf coasts	331	75, 453. 34	133	198	92
Pacific coast	24	8, 373. 13	13	11	11
Great lakes	62	19, 066. 20	19	43	1
Rivers	25	5, 203. 53	4	21	
At sea or in foreign waters	88	40, 591. 50	60	28	90
Total	530	148, 687. 70	229	301	194
Vessels collided:					
Atlantic and Gulf coasts	345	107, 923. 90	22	323	12
Pacific coast	20	14, 445. 02	1	19	
Great lakes	114	46, 218. 23	3	111	2
Rivers	44	19, 964. 72	5	39	2
At sea or in foreign waters	79	29, 730. 59	8	71	19
Total	602	218, 282. 46	39	563	35
Other causes:					
Atlantic and Gulf coasts	293	69, 174. 10	30	263	73
Pacific coast	11	6, 213. 91		11	1
Great lakes	116	33, 652. 31	8	108	37
Rivers	102	23, 770. 14	56	46	49
At sea or in foreign waters	342	138, 608. 60	81	261	352
Total	864	271, 479. 06	175	689	512
Grand total	2, 101	658, 877. 12	528	1, 573	*854

RECAPITULATION.

Atlantic and Gulf coasts	1, 011	256, 115. 12	215	796	204
Pacific coast	55	29, 032. 06	14	41	12
Great lakes	304	101, 957. 05	40	264	49
Rivers	179	49, 599. 02	67	112	51
At sea or in foreign waters	552	222, 173. 87	192	360	538
Total	2, 101	658, 877. 12	528	1, 573	*854

	Atlantic and Gulf coasts.	Pacific coast.	Great lakes.	Rivers.	At sea or in foreign waters.	Aggregate.
Total value vessels involved	$18, 241, 596	$1, 769, 200	$4, 735, 100	$4, 071, 250	$11, 918, 543	$40, 735, 689
Total value cargoes involved	7, 374, 380	496, 548	1, 737, 139	1, 141, 035	12, 068, 492	22, 817, 594
Aggregate	25, 615, 976	2, 265, 748	6, 472, 239	5, 212, 285	23, 987, 035	63, 553, 283
Total insurance on vessels	3, 731, 596	438, 800	1, 770, 535	805, 316	4, 677, 930	11, 424, 177
Total insurance on cargoes	3, 135, 663	92, 000	897, 391	521, 363	7, 950, 682	12, 597, 099
Aggregate	6, 867, 259	530, 800	2, 667, 926	1, 326, 679	12, 628, 612	24, 021, 276
Total losses to vessels	2, 903, 010	351, 529	530, 986	659, 416	5, 185, 230	9, 630, 171
Total losses to cargoes	895, 571	18, 400	166, 856	309, 308	3, 487, 033	4, 877, 168
Aggregate	3, 798, 581	369, 929	697, 842	968, 724	8, 672, 263	14, 507, 339
Total ton'ge vessels involved	256, 115. 12	29, 032. 06	101, 957. 05	49, 599. 02	222, 173. 87	658, 877. 12
Total tonnage vessels lost	44, 576. 51	5, 123. 04	8, 314. 73	11, 672. 28	72, 440. 39	142, 126. 95

* In addition to the number of lives lost here reported, 79 lives were lost in cases where no other casualty occurred to the vessel, making the total number of lives lost 933.

As the appended tables include all casualties involving losses as low as $50 for the purpose of exhibiting their nature, causes, and localities, the character of vessels, loss of life, and other information of importance, the following table of disasters, involving damage amounting to $500 and upward (damage less than that amount to vessels and cargoes being considered unimportant in a pecuniary sense), is subjoined, the corresponding table for the two previous years being also reprinted for the purpose of comparison.

Fiscal year ending June 30, 1876.

	Amount of losses.														
	$500 to $1,000.	$1,000 to $2,000.	$2,000 to $5,000.	$5,000 to $10,000.	$10,000 to $20,000.	$20,000 to $30,000.	$30,000 to $40,000.	$40,000 to $50,000.	$50,000 to $75,000.	$75,000 to $100,000.	$100,000 to $200,000.	$200,000 to $300,000.	$300,000 and over.	Unknown.	Total.
Atlantic and Gulf coasts	148	136	123	69	43	16	4	3	5	2	....	....	2	91	642
Pacific coast	7	4	7	16	8	2	1	1	1	1	1	....	....	7	56
Great lakes	58	29	56	25	15	6	6	4	2	2	2	....	....	17	222
Rivers	8	10	13	14	11	4	2	3	5	....	2	....	1	6	79
At sea or in foreign waters	36	29	46	56	50	26	12	11	3	1	3	....	2	7	282
Total	257	208	245	180	127	54	25	22	16	6	8	....	5	128	1,281

Fiscal year ending June 30, 1877.

	Amount of losses.														
	$500 to $1,000.	$1,000 to $2,000.	$2,000 to $5,000.	$5,000 to $10,000.	$10,000 to $20,000.	$20,000 to $30,000.	$30,000 to $40,000.	$40,000 to $50,000.	$50,000 to $75,000.	$75,000 to $100,000	$100,000 to $200,000.	$200,000 to $300,000.	$300,000 and over.	Unknown.	Total.
Atlantic and Gulf coasts	155	107	119	72	42	13	10	2	8	....	4	....	1	55	588
Pacific coast	4	6	10	2	1	2	1	....	1	....	1	....	....	2	30
Great lakes	29	18	25	9	9	7	....	1	1	1	....	....	....	11	111
Rivers	15	20	28	17	14	2	3	2	3	....	1	....	....	4	109
At sea or in foreign waters	50	53	87	66	53	33	9	15	17	9	11	2	2	33	440
Total	253	204	269	166	119	57	23	20	30	10	17	2	3	105	1,278

Fiscal year ending June 30, 1878.

	Amount of losses.														
	$500 to $1,000.	$1,000 to $2,000.	$2,000 to $5,000.	$5,000 to $10,000.	$10,000 to $20,000.	$20,000 to $30,000.	$30,000 to $40,000.	$40,000 to $50,000.	$50,000 to $75,000.	$75,000 to $100,000.	$100,000 to $200,000.	$200,000 to $300,000.	$300,000 and over.	Unknown.	Total.
Atlantic and Gulf coasts	131	85	87	52	34	9	7	6	5	3	3	2	1	62	487
Pacific coast	12	16	18	8	12	2	1	....	....	....	1	....	....	1	71
Great lakes	42	43	47	24	14	4	4	1	1	....	....	....	....	26	206
Rivers	15	13	14	3	9	4	1	3	2	4	1	....	....	4	73
At sea or in foreign waters	53	51	42	54	41	24	13	6	6	5	10	1	1	35	342
Total	253	208	208	141	110	43	26	16	14	12	15	3	2	128	1,179

The subjoined table shows, by localities, the total number of vessels meeting with casualties, the total values of vessels and cargoes, the totals of losses to both and the total tonnage of vessels involved and of vessels totally lost during the fiscal years 1876–'77 and 1877–'78, with the percentages of increase or decrease of the latter compared with the former.

Total number of vessels involved.

	1876–'77.	1877–'78.	Per cent.
Atlantic	1,003	843	Decrease of 15.95 per cent.
Pacific	52	97	Increase of 86.54 per cent.
Great lakes	295	470	Increase of 59.32 per cent.
Rivers	175	121	Decrease of 30.86 per cent.
At sea or in foreign waters	537	411	Decrease of 23.46 per cent.
Aggregate	2,062	1,942	Decrease of 5.82 per cent.

Total value of vessels and cargoes involved.

	1876–'77.	1877–'78.	Per cent.
Atlantic	$25,581,876	$17,975,140	Decrease of 29.73 per cent.
Pacific	2,220,908	3,337,243	Increase of 50.26 per cent.
Great lakes	6,046,489	8,683,875	Increase of 43.62 per cent.
Rivers	5,177,635	3,144,540	Decrease of 39.27 per cent.
At sea or in foreign waters	23,355,202	17,937,974	Decrease of 23.19 per cent.
Aggregate	62,382,110	51,078,772	Decrease of 18.12 per cent.

Total loss to vessels and cargoes.

	1876–'77.	1877–'78.	Per cent.
Atlantic	$3,783,656	$3,749,280	Decrease of .91 per cent.
Pacific	367,179	532,091	Increase of 44.91 per cent.
Great lakes	692,992	968,996	Increase of 39.82 per cent.
Rivers	962,424	1,147,009	Increase of 19.18 per cent.
At sea or in foreign waters	8,539,333	5,692,523	Decrease of 33.34 per cent.
Aggregate	14,345,584	12,089,899	Decrease of 15.72 per cent.

Total tonnage of vessels involved.

	1876–'77.	1877–'78.	Per cent.
Atlantic	255,319.12	191,702	Decrease of 24.92 per cent.
Pacific	28,469.06	30,265	Increase of 6.31 per cent.
Great lakes	96,755.05	144,349	Increase of 49.19 per cent.
Rivers	49,256.02	38,161	Decrease of 22.53 per cent.
At sea or in foreign waters	212,182.87	174,177	Decrease of 17.91 per cent.
Aggregate	641,982.12	578,654	Decrease of 9.86 per cent.

Total tonnage of vessels totally lost.

	1876–'77.	1877–'78.	Per cent.
Atlantic	44,384.51	35,503	Decrease of 20.01 per cent.
Pacific	5,123.04	3,590	Decrease of 29.92 per cent.
Great lakes	8,288.73	13,197	Increase of 59.21 per cent.
Rivers	11,526.28	12,736	Increase of 10.50 per cent.
At sea or in foreign waters	70,577.39	52,007	Decrease of 26.31 per cent.
Aggregate	139,899.95	117,033	Decrease of 16.34 per cent.

From the foregoing figures it will be seen that the total number of casualties in the year 1877-'78 was 5.82 per cent. less than in the year 1876-'77; that on the Atlantic and Gulf coasts there was a decrease; on the Pacific coast and on the lakes an increase of 86.54 and 59.32 per cent., respectively. On the rivers and at sea or in foreign waters, a considerable decrease.

The values of vessels and cargoes, the tonnage of vessels involved, and the loss to vessels and cargoes on the Pacific coast; the values of vessels and cargoes, the tonnage of vessels involved, the loss to vessels and cargoes, and the tonnage of vessels totally lost, on the lakes; and the loss to vessels and cargoes, and the tonnage of vessels totally lost, on the rivers, have been in excess of those of the year 1876-'77.

The increase in the number of disasters and the decrease of tonnage of vessels totally lost on the Pacific coast is attributable to the numerous gales on that coast during the year and the greater number of small vessels involved. It will be seen by table 24, that the number of vessels suffering casualty on this coast in the year 1877-'78 was 97, involving a tonnage of only 30,265, while in the previous year a tonnage of 28,469.06 was involved in 52 disasters. During the past year there were 29 total losses, involving but 3,590 tons, while the 14 total losses of the previous year involved a tonnage of 5,123.04.

The increase in the statistics of disasters on the lakes is to be accounted for by the longer duration of the season of navigation, and the unusually high winds and severe storms encountered. The closing of navigation the previous year occurred at an unusually early date.

The increase in the loss to vessels and cargoes, and in the tonnage of vessels totally lost on the rivers, notwithstanding the diminution of the number of casualties and in the values of vessels and cargoes involved therein, is chiefly accounted for by an unusual number of large vessels and cargoes destroyed by fire.

On the 30th of June, 1878, the total number of registered, enrolled, and licensed vessels belonging to the United States was 25,264, representing a tonnage of 4,212,764.54. Of this number 1,860, having a total tonnage of 554,323, met with casualties during the year, being 7.3 per cent. of the total number of vessels, and 13 per cent. of the aggregate tonnage.

The following exhibit shows the number of steam and sailing vessels, canal-boats, and barges registered, enrolled, and licensed, belonging to the United States on June 30, 1878; the number of each class which have met with disasters during the year, and the ratio of casualties to the number of vessels:

Classification.	Number of vessels belonging to the United States.	Number of casualties to vessels.	Ratio of casualties to number of vessels.
Steam-vessels	4,472	303	As 1 to 14.8
Sailing-vessels	17,523	1,513	As 1 to 11.6
Canal-boats	1,071	2	As 1 to 535.5
Barges	2,198	42	As 1 to 52.3
Total	25,264	1,860	As 1 to 13.6

During the year 583 vessels were reported as having met with collisions, but as two vessels were engaged in each collision (though in a

few instances three or more collided with each other in gales, &c.), the actual casualties of this nature were about one-half that number.

Seventy-one foreign vessels, having an aggregate tonnage of 35,011, met with disasters in American waters during the year. The nationalities of these vessels are shown in certain of the accompanying tables.

In addition to the lives lost in the disasters to vessels which are embraced in the tables, 92 persons perished by drowning or by accident on board, out of crews employed on 77 different vessels. In these cases neither vessels nor cargoes suffered damage, the persons drowned having been lost overboard or having perished by the capsizing of small boats in which they had left their vessels to attend fishing trawls, or for some other purpose. In some instances lives were lost by falling to the deck from aloft, and by the giving way of the vessel's rigging, &c.

These vessels are not included in any of the tables except 63 and 64.

The following exhibit shows the number of persons on board vessels suffering casualties, the number of lives lost, the ratio of those lost to the number on board, and the ratio of lives lost to the number of casualties for the last four fiscal years:

Fiscal year.	Number of casualties.	Number of persons on board.	Number of lives lost.	Ratio of lives lost to number on board.	Ratio of lives lost to number of casualties.
1874-'75	1,610	20,216	*894	As 1 to 22.6	As 1 to 1.8
1875-'76	2,173	23,602	*885	As 1 to 26.6	As 1 to 2.4
1876-'77	2,062	28,139	*817	As 1 to 34.4	As 1 to 2.5
1877-'78	1,942	25,133	*598	As 1 to 42	As 1 to 3.2

* This number is exclusive of lives lost where vessels suffered no damage.

The above statement shows the noteworthy and gratifying fact of a constant and rapid decrease in the number of lives lost in proportion to the number of persons on board vessels suffering casualty, and a similar decrease in the number of lives lost in proportion to the number of disasters. It also shows a lessening in the number of disasters during the last two years.

Thus, it will be seen, the decrease in the number of disasters between 1875-'76 and 1876-'77 is 5.10 per cent., and between 1876-'77 and 1877-'78 is 5.82 per cent., making a decrease in the two years of nearly 11 per cent. The decrease in the number of lives lost in proportion to the number of persons on board vessels subjected to casualty since 1874-'75 is nearly 50 per cent. within the three years; there is also a similar decrease in the proportion of lives lost to the number of casualties.

This remarkable decrease in the mortality attending shipwreck is undoubtedly referable to the unprecedented agitation of the public mind within the last few years with respect to marine disasters, which has resulted in protective legislation, involving an increase in the number of life-saving stations, light-houses, beacons, and buoys, and the institution of improved steamboat inspections and regulations for navigation, and has also resulted in valuable inventions for the management of vessels, as well as for the saving of life in case of accident, besides leading ship-owners to exercise greater discrimination in the selection of their officers and equipments and care for the condition of their ships.

During the past year there were but 112 casualties resulting in the

loss of life, exclusive of the 92 lives lost from the 77 vessels sustaining no damage, heretofore mentioned, against 155 in the preceding year. In this number, however, were two cases of terrible shipwreck, viz: those of the United States naval steamer Huron, November 24, 1877, and the steamship Metropolis, January 31, 1878, on the coast of North Carolina, resulting in the total destruction of the vessels and the loss of 183 lives, the circumstances of which have been described in another part of this report.

Notwithstanding the greater care of ship-owners in the respect previously alluded to, the reports of casualties received during the past year give the same evidences referred to in last year's report of a continuance of the practice of sending to sea old and rotten hulls at the great risk of life and property on board, practices which will probably continue until arrested by some definite legislation.

TABLES.

ATLANTIC AND GULF COASTS.

TABLE 1.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June 30, 1878, showing the* NUMBER *and* VALUE *of* VESSELS *and* CARGOES *and amount of* LOSS *to same where known.*

Months.	Total value of vessels.		Number of vessels, value unknown.	Total value of cargoes.		Number of cargoes, value unknown.	Loss to vessels.		Number of vessels totally lost, amount unknown.	Number of vessels damaged, amount unknown.	Loss to cargoes.		Number of cargoes totally lost, amount unknown.	Number of cargoes not damaged, or damage unknown.
	Number.	Amount.		Number.	Amount.		Number.	Amount.			Number.	Amount.		
July	59	$2, 081, 300	2	36	$678, 595	3	54	$151, 074	....	7	17	$159, 470	....	22
August	39	617, 140	....	24	42, 618	3	36	37, 729	....	3	9	5, 070	....	18
September	81	1, 704, 760	2	52	1, 171, 021	2	76	126, 825	....	7	27	100, 956	1	26
October	77	1, 060, 825	12	56	272, 989	16	75	174, 083	....	14	24	24, 740	....	48
November	92	1, 417, 892	7	63	344, 281	7	87	773, 905	....	12	28	72, 343	....	42
December	83	858, 360	5	61	582, 964	5	79	196, 760	....	9	29	155, 215	....	37
January	126	1, 445, 050	7	93	817, 870	7	123	425, 622	1	9	49	214, 720	....	51
February	57	1, 529, 900	2	39	734, 635	4	53	345, 276	....	6	16	235, 523	....	27
March	55	477, 150	4	42	252, 346	6	51	162, 824	....	8	22	33, 666	....	26
April	47	866, 200	1	29	207, 795	1	45	141, 050	....	3	14	14, 555	....	16
May	44	340, 850	2	31	50, 029	3	42	72, 258	....	4	18	14, 709	....	16
June	36	382, 150	3	25	38, 420	3	35	105, 562	....	4	9	5, 345	....	19
Total	796	12, 781, 577	47	551	5, 193, 563	60	756	2, 712, 968	1	*86	262	1, 036, 312	1	348

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 2.

TABLE 2.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *showing the number of* VESSELS TOTALLY LOST, *the number* DAMAGED, *aggregate* TONNAGE *of vessels totally lost, number of* PASSENGERS *and* CREW, *and number of* LIVES LOST.

Months.	Number of disasters resulting in total loss to vessels.	Number of disasters resulting in partial damage to vessels.	Whether total or partial loss unknown.	Number of casualties resulting in no damage to vessels.	Total.	Total tons burden of vessels totally lost.	Total number of crew, including master, &c.	Total number of passengers.	Total number of lives lost.
July	19	35	2	5	61	3,917	638	670	4
August	10	26	....	3	39	784	385	1,103	3
September	25	51	2	5	83	2,380	678	668	4
October	16	59	12	2	89	2,108	600	263	9
November	19	68	6	6	99	3,183	827	285	114
December	19	60	4	5	88	3,972	565	142	7
January	36	88	6	3	133	7,009	927	692	129
February	15	38	2	4	59	3,910	607	612	16
March	15	36	4	4	59	3,482	337	7	2
April	8	37	1	2	48	1,167	480	478	1
May	9	33	2	2	46	1,824	267	27	3
June	5	30	3	1	39	867	221	27	2
Total	196	561	44	42	843	35,503	6,532	4,974	294

TABLE 3.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *showing the number of* VESSELS *and* CARGOES INSURED *and* UNINSURED, *and the* AMOUNT *of* INSURANCE, *where known.*

Months.	Number of vessels and cargoes reported to be insured, and the amount of insurance.					Number of vessels and cargoes reported not insured.		Number of vessels and cargoes, whether insured or not unknown.		Vessels in ballast.
	Vessels.		Cargoes.		Total amount of insurance.					
	Number.	Amount.	Number.	Amount.		Vessels.	Cargoes.	Vessels.	Cargoes.	
July	15	$154,450	11	$246,850	$401,300	40	16	6	12	22
August	12	222,360	5	8,050	230,410	24	13	3	9	12
September	18	290,850	18	128,518	419,368	57	23	8	13	29
October	17	150,725	22	121,259	271,984	56	24	16	26	17
November	24	279,220	25	94,700	373,920	67	27	8	18	29
December	29	135,650	30	349,535	485,185	51	21	8	15	22
January	27	138,550	51	431,466	570,016	96	28	10	21	33
February	21	339,950	16	370,548	710,498	32	16	6	11	16
March	17	81,600	16	163,700	245,300	37	22	5	10	11
April	21	375,950	13	116,600	492,550	26	11	1	6	18
May	12	36,100	12	22,400	58,500	29	10	5	12	12
June	12	101,700	8	16,000	117,700	24	16	3	4	11
Total	225	2,307,105	227	2,069,626	4,376,731	539	227	79	157	232

TABLE 4.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *distinguishing the* NATURE *of each casualty.*

Nature of casualty.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Foundered	2	3	16	7	4	6	....	....	2	3	2	1	46
Stranded	19	12	24	25	32	30	73	20	18	13	17	7	290
Collided	28	17	22	41	40	34	26	20	24	22	14	12	300
Damage to hull, rudder, rigging, &c	3	1	6	10	14	9	17	5	7	3	4	7	86
Damage to machinery	....	1	1	....	....	....	4	4	....	1	1	....	12
Capsized	....	1	2	2	2	....	....	1	....	2	1	....	11
Explosion of boiler	....	1	....	....	....	....	....	....	....	....	....	....	1
Dismasted	....	....	....	....	1	....	2	....	1	1	3	4	12
Fire	4	....	6	1	2	2	2	5	6	1	....	3	32
Lost deck-load	....	....	....	....	1	....	3	....	....	1	....	1	6
Abandoned	....	....	....	....	....	....	....	....	....	....	....	1	1
Miscellaneous	....	....	3	....	....	1	....	1	....	1	2	....	8
Scuttled	1	....	....	....	....	....	....	....	....	....	....	....	1
Sprung a leak	1	1	3	3	1	4	1	3	....	....	2	2	21
Struck by lightning	2	2	....	....	....	....	....	....	....	....	....	....	4
Struck wharf, bridge, &c	1	....	....	....	2	....	4	....	1	....	....	1	9
Struck sunken wreck	....	....	....	....	....	1	1	....	....	....	....	....	2
Water-logged	....	....	....	....	....	1	....	....	....	....	....	....	1
Total	61	39	83	89	99	88	133	59	59	48	46	39	843

TABLE 5.—*Abstract of returns of disasters (excluding collisions) to vessels and cargoes on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *distinguishing the* CAUSE *of each disaster.*

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 1.—*Causes connected with the weather:*					
Gales, hurricanes, &c	19	132	102	......	253
Calms, currents and tides	......	30	1	......	31
Heavy seas	4	24	15	......	43
Fog, &c	......	32	3	......	35
Lightning	......	......	4	......	4
Darkness	......	7	......	......	7
Total of Class 1	23	225	125	......	373
CLASS 2.—*Causes connected with vessels' equipments or stowage:*					
Defective hull, masts, rigging, &c	2	......	4	......	6
Error in compass or chronometer	......	5	......	......	5
Inefficient equipments, charts, &c	......	1	......	......	1
Total of Class 2	2	6	4	......	12
CLASS 3.—*Causes connected with navigation and seamanship:*					
Error, &c., of masters, officers, or crew	2	21	4	......	27
Error, &c., of pilot	......	3	1	......	4
Total of Class 3	2	24	5	......	31
CLASS 4.—*Causes connected with machinery or boilers:*					
Damage to machinery	......	......	13	......	13
Explosion of boiler, bursting of steam-pipes, &c	......	......	2	......	2
Total of Class 4	......	......	15	......	15
CLASS 5.—*Other causes:*					
Inevitable accident	......	4	6	......	10
Fire	......	......	19	......	19
Scuttled	......	......	1	......	1
Incendiarism	......	......	2	......	2
Absence of lights or buoys	......	4	......	......	4
Struck sunken wreck, rocks, &c	......	3	2	......	5
Want of power in steam-tug	2	......	......	......	2
Waterlogged	......	1	......	......	1
Sprung a leak	17	5	9	......	31
Miscellaneous	......	7	14	......	21

TABLE 5.—*Abstract of returns of disasters, &c.*—Continued.

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 5.—*Other causes*—Continued.					
Unknown	......	11	4	......	15
Want of pilot	......	......	1	......	1
Total of Class 5	19	35	58	......	112
Aggregate	46	290	207	......	543

TABLE 6.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *showing the number of vessels* COLLIDED, *and distinguishing the* CAUSE *of each disaster.*

Cause of disaster.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Accidental	....	2	2	....	2	4	....	....	2	6	4	....	22
Bad management	....	....	....	2	2	....	....	....	....	2	....	....	6
Carelessness	4	....	4	4	2	2	....	2	4	2	2	....	26
Darkness	4	2	2	6	4	....	....	2	....	....	2	2	24
Error in judgment	2	....	2	....	....	....	....	....	....	....	....	....	4
"Fault of other vessel"	....	....	2	2	6	2	4	2	8	6	2	4	38
Error of pilot	2	2	....	....	....	....	....	4	....	....	....	....	8
Fault of tug towing	....	3	....	....	4	2	....	....	2	....	....	....	11
Thick and foggy weather	12	4	6	....	....	2	4	2	....	2	2	4	38
Adverse current	....	....	....	....	....	4	....	4	....	....	2	....	10
Dragged anchors	....	....	2	9	2	2	6	....	....	....	....	....	21
Drifted	....	....	....	2	....	....	....	....	....	....	....	....	2
High winds	....	....	....	2	4	2	2	....	4	2	....	....	16
Mistake in lights	....	....	....	....	....	2	2	....	....	....	....	....	4
Tides	....	....	....	....	....	....	....	....	....	2	....	....	2
Misstayed	2	2	....	....	....	2	....	....	....	....	....	....	6
Parted chains, &c	....	....	....	4	4	....	4	....	2	....	....	....	14
Stress of weather	....	....	....	8	....	....	4	....	....	....	....	....	12
"Unavoidable"	....	2	2	....	6	4	....	2	2	....	....	....	18
Negligence	....	....	....	....	2	....	....	....	....	....	....	....	2
Want of proper lights	2	....	....	....	2	6	....	....	....	....	....	....	10
Unknown	....	....	....	2	....	....	....	2	....	....	....	2	6
Total	28	17	22	41	40	34	26	20	24	22	14	12	300

TABLE 7.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* DESCRIPTION.

Description of vessels.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Barges	....	2	1	1	1	1	....	....	....	....	....	....	6
Barks	4	....	1	4	2	5	6	6	8	1	....	....	32
Barkentines	....	....	2	1	1	....	....	1	....	....	1	....	6
Brigs	1	2	4	1	6	8	4	1	1	1	1	....	25
Brigantine	....	....	1	....	....	....	....	....	....	....	....	....	1
Ferry-boat	....	....	....	....	....	1	....	....	....	....	....	....	1
Schooners	86	23	48	66	71	58	107	35	40	32	37	30	583
Scows	....	....	....	....	....	....	....	....	2	....	....	....	2
Ships	2	....	2	1	1	....	....	1	....	1	1	....	9
Sloops	3	....	5	5	3	9	4	....	4	3	....	3	39
Steamers	12	11	17	5	10	11	11	11	8	10	4	5	115
Steamships	1	1	1	....	....	....	1	4	....	....	....	1	9
Yachts	1	....	....	1	1	....	....	....	....	....	1	....	4
Unknown	1	....	1	4	3	....	....	....	1	....	1	....	11
Total	61	39	83	89	99	88	133	59	59	48	46	39	843

TABLE 8.—*Abstract of returns of disasters to* FOREIGN *vessels on the* ATLANTIC *and* GULF *coasts during the year ending June 30, 1878, showing* NATIONALITY *and* DESCRIPTION, *and distinguishing those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Nationality and rig.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
Austrian bark																1										1	1
British bark	1	1					1				1	2		1	1	1		1				1			4	7	11
British barkentine						1		1																		2	2
British brig			1		1																	1			2	1	3
British schooner							1	2		1		1	2		1						1	1			5	5	10
British ship																1										1	1
British steamer										1		1				1	1								1	3	4
British steamship															1										1		1
German bark								3						1	1										1	4	5
German brig							1																		1		1
German ship								1																		1	1
German steamer																				1						1	1
Italian bark													1												1		1
Norwegian bark										1			1			1				1					1	3	4
Norwegian barkentine						1																				1	1
Norwegian ship		1				1																				2	2
Russian bark									1																1		1
Spanish schooner													1												1		1
Swedish bark						1										1										2	2
Total	1	2	1	....	1	4	3	7	1	3	1	4	5	2	4	6	1	1	....	2	1	3	....	....	19	34	53
Aggregate	3		1		5		10		4		5		7		10		2		2		4		..		53		

TABLE 9.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June 30, 1878, showing the* TONNAGE *and distinguishing the number of those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Burden of vessels.	July.		August		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
Not exceeding 50 tons	7	7	6	4	15	11	6	15	6	13	3	17	7	18	3	8	5	11	5	4	4	8	2	5	69	121	190
Over 50 and not exceeding 100 tons	2	6	1	10		12	3	12	2	17	7	15	3	27	1	5	2	10		8	2	6	1	9	24	137	161
Over 100 and not exceeding 200 tons	5	8	1	5	6	12	2	20	6	23	3	11	11	21	5	6	2	8	1	11	1	11	1	11	44	147	191
Over 200 and not exceeding 300 tons	1	6	2	1	3	5	4	8	1	7	1	5	8	9	2	6		5	1	5	1	1		3	24	61	85
Over 300 and not exceeding 400 tons	2	2		2		4	1	3	2	5	2	10	2	9	1	4	4	3		2		5		2	14	51	65
Over 400 and not exceeding 500 tons		3		1	1	2		1		4	1	5	2	3	1	1	1	2		1		2		1	6	26	32
Over 500 and not exceeding 600 tons		1		1		1		2	2	1	1	1		4		3			1	1		2		1	4	18	22
Over 600 and not exceeding 700 tons	1	2				3		2		2		1	1			3				3		1	1		3	17	20
Over 700 and not exceeding 800 tons				3		1				1						2				1						8	8
Over 800 and not exceeding 900 tons													2		1			1							3	1	4
Over 900 and not exceeding 1,000 tons		3												1	1	1									1	5	6
Over 1,000 and not exceeding 1,100 tons						1					1	1					1				1			1	3	3	6
Over 1,100 and not exceeding 1,200 tons						1																				1	1
Over 1,200 and not exceeding 1,300 tons		1		1												1										3	3
Over 1,300 and not exceeding 1,400 tons	1																								1		1
Over 1,400 tons		2		1		3		2		1				2		2				3						16	16
Unknown		1				2		8		6		3		3		2		4		1		1		1		32	32
Total	19	42	10	29	25	58	16	73	19	80	19	69	36	97	15	44	15	44	8	40	9	37	5	34	196	647	843
Aggregate	61		39		83		89		90		88		133		59		59		48		46		39		843		

NOTE.—In the columns of "Partial loss" in this table are included the casualties in which the vessels sustained no damage, for the number of which see appropriate column in Table 2.

TABLE 10.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June 30, 1878, showing the number of vessels and distinguishing* AGE.

Age.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Not exceeding 3 years	8	2	3	6	6	6	9	9	6	....	1	....	56
Over 3 and not exceeding 7 years	10	5	25	11	12	22	18	14	14	9	12	10	162
Over 7 and not exceeding 10 years	5	4	7	16	17	8	26	6	4	7	8	4	112
Over 10 and not exceeding 14 years	8	11	11	10	15	12	18	12	14	11	6	5	133
Over 14 and not exceeding 20 years	6	4	9	12	12	8	18	6	5	4	3	8	95
Over 20 and not exceeding 25 years	5	2	8	6	8	11	13	1	3	9	5	6	77
Over 25 and not exceeding 30 years	7	3	3	7	11	5	12	4	3	3	5	2	65
Over 30 and not exceeding 35 years	3	1	3	5	2	....	6	1	3	....	....	1	25
Over 35 and not exceeding 40 years	1	1	1	....	4	4	2	1	1	1	1	....	17
Over 40 and not exceeding 45 years	1	....	1	....	....	1	1	....	....	....	1	....	5
Over 45 and not exceeding 50 years	1	2	....	....	1	1	....	....	....	....	....	....	5
Over 50 years	....	....	....	1	1	....	....	....	....	....	....	....	2
Unknown	6	4	12	15	10	10	10	5	6	4	4	3	89
Total	61	39	83	89	99	88	133	59	59	48	46	39	843

TABLE 11.—*Abstract of returns of disasters to vessels on the* ATLANTIC *and* GULF *coasts during the year ending June 30, 1878, showing the number of vessels and distinguishing their* CARGOES.

Cargoes.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Assorted	....	1	....	....	....	....	3	....	1	1	....	....	6
Ballast	22	12	29	17	29	22	33	16	11	18	12	11	232
Bone-black, alkali, &c	....	....	....	....	....	1	....	...	....	1	....	....	2
Cement, clay, &c	....	....	1	....	2	2	....	....	....	....	....	....	5
Chalk	....	....	....	....	....	....	1	....	....	....	....	....	1
Coal	10	3	10	20	15	15	33	6	9	3	9	9	142
Cocoa-nuts, &c	....	....	....	....	1	....	1	....	....	....	....	....	2
Coffee, sugar, molasses, &c	1	....	....	1	3	3	4	....	4	1	....	....	17
Cotton	1	....	....	....	....	2	....	2	....	....	....	....	5
Fertilizers	....	1	1	1	1	5	2	....	....	....	....	....	11
Fish and fishing gear	2	4	1	9	3	2	4	2	....	2	3	4	36
Flour, &c	2	1	....	1	1	1	1	....	....	....	1	....	8
Fruits and vegetables	1	....	3	....	1	....	3	1	1	....	4	....	14
Grain, &c	....	....	1	....	3	1	3	2	4	....	....	1	15
Hay	....	....	2	....	....	....	....	....	....	....	....	....	2
Hemp, &c	....	....	....	....	....	1	....	....	....	....	....	....	1
Hides, &c	....	....	....	....	....	....	....	....	....	....	1	....	1
Ice	1	2	....	....	3	....	....	2	2	2	1	....	13
Iron, steel, &c	1	1	1	1	2	3	....	1	....	....	2	....	12
Laths	1	....	....	1	1	....	....	....	....	....	....	....	3
Lime, plaster, sand, rosin, &c	....	....	7	1	5	2	....	4	3	2	2	2	28
Live stock	....	....	....	....	....	1	....	....	....	....	....	1	2
Logwood, &c	1	....	....	....	....	....	2	2	....	....	....	....	5
Lumber, timber, &c	3	1	7	5	4	1	5	3	2	7	4	4	46
Machinery	....	....	....	....	....	....	....	....	....	....	....	1	1
Merchandise	1	2	9	3	3	4	8	6	1	....	2	....	39
Miscellaneous	2	1	1	3	1	5	12	5	4	2	....	....	36
Naval stores	1	....	....	....	....	....	....	....	2	....	....	....	3
Nuts, raisins, &c	....	....	....	....	1	....	....	....	....	....	....	....	1
Oil, &c	....	....	....	....	1	1	....	1	....	....	....	1	4
Oysters	....	....	1	3	....	2	2	3	8	1	1	....	21
Phosphate rock	2	1	....	....	...	1	1	....	1	....	....	....	6
Piles	....	....	....	1	...	....	....	....	....	....	....	....	1
Provisions, &c	....	....	....	1	...	..	....	....	1	....	....	....	2
Railroad-ties	....	....	....	....	...	..	2	....	1	1	....	....	4
Salt, &c	1	4	....	3	3	1	1	....	....	1	....	1	15
Slate, &c	....	1	....	....	....	....	....	....	....	....	....	....	1
Stone and brick	3	2	2	1	6	5	3	....	....	1	2	....	25
Staves	....	....	1	...	1	....	....	....	....	....	....	....	2
Sulphur	....	....	....	....	...	....	....	....	...	1	....	....	1
Tobacco	....	....	....	2	...	....	....	....	....	....	....	....	2
Wood	1	1	5	3	3	2	4	....	....	3	....	1	23
Unknown	4	1	1	12	6	5	5	3	4	1	2	3	47
Total	61	39	83	89	99	88	133	59	59	48	46	39	843

TABLE 12.—*Summary*—ATLANTIC *and* GULF *coasts.*

Nature of casualties.	Number of vessels.	Total number of tons.	Laden.	Ballast.	Unknown whether laden or not.	Total loss.	Partial and unknown loss.	Number of passengers.	Number of crew.	Total on board.	Total number of lives lost.
Founderings	46	4,618	32	14	......	34	12	3	186	189	6
Strandings	290	52,907	215	71	4	127	163	427	2,080	2,507	249
Vessels collided	300	79,605	173	84	43	15	285	3,623	2,474	6,097	20
Other causes	207	54,572	144	63	......	20	187	921	1,792	2,713	19
Total	843	191,702	564	232	47	196	*647	4,974	6,532	11,506	294

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 2.

PACIFIC COAST.

TABLE 13.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June* 30, 1878, *showing the* NUMBER *and* VALUE OF VESSELS *and* CARGOES, *and amount of* LOSS *to same, where known.*

Months.	Total value of vessels.		Number of vessels, value unknown.	Total value of cargoes.		Number of cargoes, value unknown.	Loss to vessels.		Number of vessels totally lost, amount unknown.	Number of vessels damaged, amount unknown.	Loss to cargoes.		Number of cargoes totally lost, amount unknown.	Number of cargoes not damaged, or damage unknown.
	Number.	Amount.		Number.	Amount.		Number.	Amount.			Number.	Amount.		
July	4	$529,000	1	4	$129,901	1	4	$2,200	....	1	1	$933	....	4
August	2	110,000	....	....	....	1	2	5,500	....	....	....	....	....	1
September	7	52,500	....	4	2,484	....	7	6,860	....	....	8	1,484	....	1
October	13	441,500	....	7	118,100	....	12	33,675	....	1	3	3,600	....	4
November	13	357,000	....	12	168,576	....	13	44,292	....	....	7	2,846	....	5
December	8	222,500	....	6	181,038	1	8	134,400	....	....	7	106,198	....	....
January	11	115,600	1	6	21,400	....	11	68,920	....	1	5	17,050	....	1
February	19	179,250	....	13	41,244	....	18	25,775	....	1	10	19,198	....	3
March	4	30,500	....	....	....	....	4	23,000	....	....	....	....	....	....
April	4	153,000	....	4	285,900	....	4	15,050	....	....	1	150	....	3
May	9	131,000	....	5	26,750	....	9	8,360	....	....	1	600	....	4
June	1	30,000	....	1	10,000	....	1	4,000	....	....	1	8,000	....	....
Total	95	2,351,850	2	62	985,393	3	93	372,032	....	*4	39	160,059	....	26

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 14.

TABLE 14.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June* 30, 1878, *showing the number of vessels* TOTALLY LOST, *the number* DAMAGED, *aggregate* TONNAGE *of vessels* TOTALLY LOST, *number of* PASSENGERS *and* CREW, *and the number of* LIVES LOST.

Months.	Number of disasters resulting in total loss to vessels.	Number of disasters resulting in partial damage to vessels.	Whether total or partial loss unknown.	Number of casualties resulting in no damage to vessels.	Total.	Total tons burden of vessels totally lost.	Total number of crew, including master, &c.	Total number of passengers.	Total number of lives lost.
July	......	4	......	1	5	....	145	84	....
August	......	2	......	......	2	....	25	9	....
September	2	5	......	......	7	56	39	......	1
October	4	8	......	1	13	416	144	323	2
November	5	8	......	......	13	298	155	274	1
December	5	3	......	......	8	1,771	95	40	....
January	6	5	1	......	12	769	72	......	4
February	4	14	......	1	19	59	112	1	14
March	3	1	......	......	4	221	21	4	6
April	......	4	......	......	4	....	85	28	....
May	......	9	......	......	9	....	72	7	....
June	......	1	......	......	1	....	10	4	....
Total	29	64	1	3	97	3,590	975	774	28

TABLE 15.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June* 30, 1878, *showing the number of* VESSELS *and* CARGOES INSURED *and* UNINSURED, *and the* AMOUNT OF INSURANCE, *where known.*

Months.	Number of vessels and cargoes reported to be insured, and the amount of insurance.					Number of vessels and cargoes reported not insured.		Number of vessels and cargoes, whether insured or not insured, unknown.		
	Vessels.		Cargoes.		Total amount of insurance.					
	Number.	Amount.	Number.	Amount.		Vessels.	Cargoes.	Vessels.	Cargoes.	Vessels in ballast.
July	1	$6,000	......	....	$6,000	3	2	1	3	....
August	2	65,000	......	....	65,000	....	....	....	1	1
September	2	14,000	......	....	14,000	4	3	1	1	3
October	8	60,250	......	....	60,250	3	5	2	2	6
November	10	199,800	3	13,400	213,200	3	6	....	3	1
December	8	156,500	3	81,140	237,640	....	3	....	1	1
January	6	45,500	......	....	45,500	5	6	1	....	6
February	12	71,350	1	13,000	84,350	7	12	....	....	6
March	4	14,300	......	....	14,300	....	....	....	....	4
April	2	49,500	......	....	49,500	2	2	....	2	....
May	7	57,500	......	....	57 500	2	5	....	....	4
June	1	19,000	......	....	19 000	....	1	....	....	....
Total	63	758,700	7	107,540	806,240	29	45	5	13	32

TABLE 16.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June 30, 1878, distinguishing the* NATURE *of each casualty.*

Months.	Foundered.	Stranded.	Collided.	Capsized.	Fire.	Damage to hull, rudder, and rigging, and loss of sails, anchors, &c.	Dismasted.	Sprung a leak.	Struck wharf.	Lost deck load.	Miscellaneous.	Total.
July	......	1	4	......	......	......	......	......	......	......	......	5
August	......	2	......	......	......	......	......	......	......	......	......	2
September	1	2	2	......	1	1	......	......	......	......	......	7
October	1	3	9	......	......	......	......	......	......	......	......	13
November	......	6	2	2	......	1	1	1	......	......	......	13
December	......	6	2	......	......	......	......	......	......	......	......	8
January	1	6	4	......	......	......	......	......	1	......	......	12
February	......	6	4	2	......	2	1	1	......	2	1	19
March	1	2	......	1	......	......	......	......	......	......	......	4
April	......	3	......	......	......	1	......	......	......	......	......	4
May	1	3	4	......	......	......	......	......	1	......	......	9
June	......	1	......	......	......	......	......	......	......	......	......	1
Total	5	41	31	5	1	5	2	2	2	2	1	97

TABLE 17.—*Abstract of returns of disasters (excluding collisions) to vessels and cargoes on the* PACIFIC *coast during the year ending June 30, 1878, distinguishing the* CAUSE *of each disaster.*

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 1.—*Causes connected with the weather:*					
Gales, hurricanes, &c	1	18	9	......	28
Heavy seas	......	8	5	......	13
Calms, currents, and tides	......	1	1	......	2
Fog, &c	......	4	1	......	5
Total of Class 1	1	31	16	......	48
CLASS 2.—*Causes connected with vessels, equipments, or stowage:*					
Inefficient equipments	......	1	......	......	1
Total of Class 2	......	1	......	......	1
CLASS 3.—*Causes connected with navigation and seamanship:*					
Error, &c., of masters, officers, or crew	......	3	1	......	4
Error of pilot	......	1	......	......	1
Total of Class 3	......	4	1	......	5
CLASS 5.—*Other causes:*					
Fire	......	......	1	......	1
Sprung a leak	4	......	......	......	4
Struck sunken rock	......	1	......	......	1
Miscellaneous	......	1	......	......	1
Unknown	......	3	2	......	5
Total of Class 5	4	5	3	......	12
Aggregate	5	41	20	......	66

NOTE.—Class 4 includes disasters arising from causes connected with machinery or boilers. No casualties are reported in this class.

TABLE 18.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June 30, 1878, showing the number of vessels* COLLIDED *and distinguishing the* CAUSE *of each disaster.*

Months.	Adverse currents.	Bad management.	Dragged anchor.	Darkness.	Error of pilot.	"Fault of other vessel."	Heavy sea.	Stress of weather.	Thick and foggy weather.	Total.
July		2			2					4
August										
September						2				2
October	3			2	2				2	9
November	2									2
December							2			2
January								2	2	4
February				2				2		4
March										
April										
May			2			2				4
June										
Total	5	2	2	4	4	4	2	4	4	31

TABLE 19.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June 30, 1878, showing the number of vessels and distinguishing their* DESCRIPTION.

Description of vessels.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Barks		1			1		3	1		1	1		8
Barkentine								1					1
Brig					1								1
Schooners	3		7	8	7	4	7	16	4	2	7		65
Ships	1				1	3							5
Sloops							1	1					2
Steamers		1		4	2	1					1	1	10
Steamships	1			1	1					1			4
Unknown							1						1
Total	5	2	7	13	13	8	12	19	4	4	9	1	97

TABLE 20.—*Abstract of returns of disasters to* FOREIGN *vessels on the* PACIFIC *coast during the year ending June 30, 1878, showing* NATIONALITY *and* DESCRIPTION *and distinguishing those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Nationality and rig.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
British ship	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Total	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Aggregate	1		....		....		....		....		....		....		....		....		....		....		....		1		......

TABLE 21.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June 30, 1878, showing the* TONNAGE *and distinguishing the number of those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Burden of vessels.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
Not exceeding 50 tons					2		1	2	2	1			4		4	3	2					1			15	7	22
Over 50 and not exceeding 100 tons		1				3	2	3	3	1	2	1		2		1		1		1		1			7	15	22
Over 100 and not exceeding 200 tons		2				1	1	2		1	2		1			7	1					2		1	5	16	21
Over 200 and not exceeding 300 tons						1								1		2						3				7	7
Over 300 and not exceeding 400 tons								1		2						1										4	4
Over 400 and not exceeding 500 tons				1									1									1			1	2	3
Over 500 and not exceeding 600 tons																1										1	1
Over 600 and not exceeding 700 tons																											...
Over 700 and not exceeding 800 tons				1																						1	1
Over 800 and not exceeding 900 tons														1						1						2	2
Over 900 and not exceeding 1,000 tons		1										1														2	2
Over 1,000 and not exceeding 1,100 tons										1										1		1				3	3
Over 1,100 and not exceeding 1,200 tons										2				1												3	3
Over 1,200 and not exceeding 1,300 tons												1														1	1
Over 1,300 and not exceeding 1,400 tons											1														1		1
Over 1,400 tons		1						1												1						3	8
Unknown														1												1	1
Total		5		2	2	5	4	9	5	8	5	3	6	6	4	15	3	1		4		9		1	29	68	97
Aggregate	5		2		7		13		13		8		12		19		4		4		9		1		97		...

NOTE.—In the columns of "Partial loss" in this table are included the casualties in which the vessels sustained no damage, for the number of which see appropriate column in Table 14.

TABLE 22.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June* 30, 1878, *showing the number of vessels and distinguishing* AGE.

Age.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Not exceeding 3 years	....	....	1	3	4	1	1	6	2	1	4	1	24
Over 3 and not exceeding 7 years	3	2	1	....	1	5	....	3	....	1	....	....	16
Over 7 and not exceeding 10 years	1	....	3	6	2	2	5	2	1	...	1	....	23
Over 10 and not exceeding 14 years	....	....	2	1	1	....	1	1	....	1	1	....	8
Over 14 and not exceeding 20 years	....	....	....	1	4	....	1	4	....	....	1	....	11
Over 20 and not exceeding 25 years	1	....	....	1	1	....	3	1	....	....	1	....	8
Over 25 and not exceeding 30 years	....	....	....	1	....	....	....	2	1	1	1	....	6
Over 30 and not exceeding 35 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 35 and not exceeding 40 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 40 and not exceeding 45 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 45 and not exceeding 50 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 50 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Unknown	....	....	....	....	....	....	1	....	....	....	....	....	1
Total	5	2	7	13	13	8	12	19	4	4	9	1	97

TABLE 23.—*Abstract of returns of disasters to vessels on the* PACIFIC *coast during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* CARGOES.

Cargoes.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Ballast	....	1	3	6	1	1	6	6	4	....	4	....	32
Coal	....	....	....	....	1	....	1	2	....	....	2	....	6
Gas-pipe	....	....	....	1	....	....	....	....	....	....	....	....	1
Fish	....	....	1	....	....	....	....	....	....	....	....	....	1
Hay	....	....	1	....	....	....	....	....	....	....	....	....	1
Lime	1	....	....	....	....	....	....	....	....	....	....	....	1
Live-stock, &c	....	....	....	1	....	....	....	....	....	....	....	....	1
Lumber	....	....	....	1	3	1	1	5	....	1	2	....	14
Merchandise	3	1	1	1	4	....	....	1	....	2	....	....	13
Produce, &c	....	....	....	1	....	1	1	....	....	....	....	1	4
Provisions, &c	....	....	....	....	....	2	....	2	....	....	....	....	4
Railroad-ties	1	....	....	....	....	....	....	....	....	....	....	....	1
Shingles, &c	....	....	....	....	....	....	....	1	....	1	....	....	2
Stone, gravel, &c	....	....	1	....	....	....	....	2	....	....	....	....	3
Timber	....	....	....	....	....	....	1	....	....	....	....	....	1
Wheat	....	....	....	....	....	3	....	....	....	....	....	....	3
Whaling outfits	....	....	....	....	1	....	....	....	....	....	....	....	1
Wood	....	....	....	2	3	....	2	....	....	....	....	....	7
Wine	....	....	....	....	....	....	....	....	....	....	1	....	1
Total	5	2	7	13	13	8	12	19	4	4	9	1	97

TABLE 24.—*Summary*—PACIFIC COAST.

Nature of casualties.	Number of vessels.	Total number of tons.	Laden.	Ballast.	Unknown whether laden or not.	Total loss.	Partial and unknown loss.	Number of passengers.	Number of crew.	Total on board.	Total number of lives lost.
Founderings	5	216	4	1	......	2	3	......	15	15	......
Strandings	41	11,707	30	11	......	19	22	90	352	442	6
Vessels collided	31	12,003	13	18	......	4	27	405	402	807	4
Other causes	20	6,339	18	2	......	4	16	279	206	485	18
Total	97	30,265	65	32	......	29	*68	774	975	1,749	28

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 14.

GREAT LAKES.

TABLE 25.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the* NUMBER *and* VALUE *of* VESSELS *and* CARGOES, *and amount of* LOSS *to same, where known.*

Months.	Total value of vessels.		Number of vessels, value unknown.	Total value of cargoes.		Number of cargoes, value unknown.	Loss to vessels.		Number of vessels totally lost, amount unknown.	Number of vessels damaged, amount unknown.	Loss to cargoes.		Number of cargoes totally lost, amount unknown.	Number of cargoes not damaged, or damage unknown.
	Number.	Amount.		Number.	Amount.		Number.	Amount.			Number.	Amount.		
July	32	$439, 080	1	19	$192, 992	1	28	$40, 514	....	5	1	$150	....	19
August	52	603, 300	2	33	221, 536	2	51	82, 140	....	3	7	23, 126	....	28
September	42	699, 550	1	27	287, 450	2	38	65, 550	....	5	10	32, 017	....	19
October	121	1, 832, 150	7	104	822, 671	7	106	157, 973	....	22	59	101, 591	....	52
November	110	1, 066, 500	1	92	546, 556	2	106	212, 397	....	5	42	85, 296	....	52
December	8	107, 500	1	4	99, 075	1	8	15, 091	....	1	4	23, 312	....	1
January	....	....	....	....	....	....	....	....	....	....	....	....	....	....
February	....	....	....	....	....	....	....	....	....	....	....	....	....	....
March	7	31, 300	....	1	500	1	7	3, 765	....	....	....	....	....	2
April	19	284, 600	2	13	132, 875	2	18	15, 826	....	3	2	460	....	13
May	27	451, 500	4	16	242, 580	4	24	10, 990	....	7	2	210	....	18
June	29	385, 600	4	20	235, 960	5	29	62, 968	....	4	7	35, 620	....	18
Total	447	5, 901, 080	23	329	2, 782, 795	27	415	667, 214	....	*55	134	301, 782	....	222

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 26.

TABLE 26.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the number of vessels* TOTALLY LOST, *the number* DAMAGED, *aggregate* TONNAGE *of vessels* TOTALLY LOST, *number of* PASSENGERS *and* CREW, *and number of* LIVES LOST.

Months.	Number of disasters resulting in total loss to vessels.	Number of disasters resulting in partial damage to vessels.	Whether total or partial loss unknown.	Number of casualties resulting in no damage to vessels.	Total.	Total tons burden of vessels totally lost.	Total number of crew, including master, &c.	Total number of passengers.	Total number of lives lost.
July	3	25	1	4	33	152	257	41	....
August	4	47	2	1	54	1, 344	388	5	1
September	7	31	1	4	43	1, 445	401	185	....
October	16	90	7	15	128	3, 528	1, 121	189	14
November	24	82	1	4	111	3, 873	868	78	21
December	1	7	1	....	9	332	53	....	....
January	....	....	....	....	....	....	....	....	....
February	....	....	....	....	....	....	....	....	....
March	2	5	....	....	7	107	39	....	2
April	1	17	2	1	21	256	185	6	....
May	1	23	4	3	31	66	254	9	....
June	4	25	4	....	33	2, 094	225	5	4
Total	63	352	23	32	470	13, 197	3, 791	518	42

TABLE 27.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the number of* VESSELS *and* CARGOES INSURED *and* UNINSURED *and the* AMOUNT OF INSURANCE, *where known.*

Months.	Number of vessels and cargoes reported to be insured and the amount of insurance.					Number of vessels and cargoes reported not insured.		Number of vessels and cargoes, whether insured or not, unknown.		Vessels in ballast.
	Vessels.		Cargoes.		Total amount of insurance.					
	Number.	Amount.	Number.	Amount.		Vessels.	Cargoes.	Vessels.	Cargoes.	
July	12	$137,500	6	$98,240	$235,740	20	12	1	2	13
August	21	200,000	12	107,555	307,555	31	16	2	7	19
September	24	306,000	19	258,150	564,150	18	7	1	3	14
October	62	781,355	42	547,625	1,328,980	58	50	8	19	17
November	46	377,925	33	361,908	739,833	63	51	2	10	17
December	3	53,000	2	84,900	137,900	5	1	1	2	4
January	....	....	....	....	....	....	....	....	....	....
February	....	....	....	....	....	....	....	....	....	....
March	....	....	....	....	....	6	1	1	1	5
April	4	49,000	5	86,000	135,000	15	7	2	3	6
May	10	111,300	7	101,730	213,030	17	7	4	6	11
June	12	143,500	9	185,700	329,200	16	7	5	9	8
Total	194	2,159,580	135	1,831,808	3,991,388	249	159	27	62	114

TABLE 28.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *distinguishing the* NATURE *of each casualty.*

Nature of casualties.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Foundered	1	1	....	4	3	....	....	....	....	....	....	1	10
Stranded	3	5	13	32	41	2	....	....	1	4	3	3	107
Collided	14	31	8	27	18	4	....	....	4	10	20	14	150
Capsized	....	....	....	....	1	....	....	....	1	....	1	2	5
Damage to hull, rudder, rigging, &c	3	5	6	32	26	....	....	....	....	2	1	10	85
Damage to machinery	6	....	3	1	1	....	....	....	....	1	1	1	14
Dismasted	....	1	2	....	3	....	....	....	....	3	1	....	10
Abandoned	....	....	....	1	....	....	....	....	....	....	....	....	1
Fire	4	4	3	2	1	....	....	....	....	....	2	1	17
Lost deck-load, &c	....	....	....	7	5	....	....	....	....	....	....	....	12
Miscellaneous	....	....	1	9	1	....	....	....	....	....	....	....	11
Sprung a leak	....	2	3	6	....	....	....	....	1	....	....	....	12
Struck by lightning	1	1	....	....	....	....	....	....	....	....	1	....	3
Struck sunken wreck, &c	1	1	....	1	2	....	....	....	....	1	....	1	7
Struck wharf, bridge, pier, &c	....	3	3	5	7	2	....	....	....	....	1	....	21
Water-logged	....	....	1	1	2	1	....	....	....	....	....	....	5
Total	33	54	43	128	111	9	....	....	7	21	31	33	470

TABLE 29.—*Abstract of returns of disasters (excluding collisions) to vessels and cargoes on the* GREAT LAKES *during the year ending June* 30, 1878, *distinguishing the* CAUSE *of each disaster.*

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 1.—*Causes connected with the weather:*					
Gales, hurricanes, &c	7	60	105	......	172
Heavy seas	1	6	36	......	43
Calms and currents	......	3	1	......	4
Fog, &c	......	13	......	......	13
Lightning	......	......	3	......	3
Darkness	......	4	2	......	6
Total of Class 1	8	86	147	......	241
CLASS 2.—*Causes connected with vessels, equipments, or stowage:*					
Defective hull, masts, rigging, &c	......	......	2	......	2
Total of Class 2	......	......	2	......	2
CLASS 3.—*Causes connected with navigation and seamanship:*					
Error, &c., of masters, officers, or crew	......	4	......	......	4
Error of pilot	......	6	2	......	8
Total of Class 3	......	10	2	......	12
CLASS 4.—*Causes connected with machinery or boilers:*					
Damage to machinery, boiler, &c	......	......	14	......	14
Total of Class 4	......	......	14	......	14
CLASS 5.—*Other causes:*					
Accidental	......	2	3	......	5
Fire	......	......	13	......	13
Absence of light	......	1	......	......	1
Want of power in steam-tug	......	2	......	......	2
Sprung a leak	2	1	4	......	7
Struck sunken wreck, rocks, &c	......	2	8	......	10
Miscellaneous	......	3	7	......	10
Unknown	......	......	3	......	3
Total of Class 5	2	11	38	......	51
Aggregate	10	107	203	......	320

TABLE 30.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing number of vessels* COLLIDED, *and distinguishing the* CAUSE *of each disaster.*

Cause of disaster.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Accidental	2	4											6
Fault of tug towing	2	9		8							6	8	33
Mismanagement	2			2									4
Darkness	2		2		4	2				4	2	2	18
High wind	2			2	6								10
Error in judgment	2		2								2		6
"Fault of other vessel"	2	2	2	4							2		12
Negligence		2											2
Thick and foggy weather		2		2						2	2		8
Adverse current		2									2	2	6
Carelessness		6		2									8
Want of proper lights		2			2								4
Damage to machinery				2									2
Misunderstanding signals, &c		2		2									4
Breaking of anchor				3									3
Stress of weather					4				2				6
Error in steering					2						2		4
Narrow channel						2							2
Misstayed									2			2	4
Parted tow-line										2			2
Freshet										2			2
"Unavoidable"											2		2
Unknown			2										2
Total	14	31	8	27	18	4			4	10	20	14	150

TABLE 31.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* DESCRIPTION.

Description of vessels.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Barges	2	1	2	7	1						2	1	16
Barks		3	1	3	3							1	11
Barkentines										1			1
Brigs				1	1								2
Schooners	16	33	26	88	90	6			6	13	21	22	321
Scows		3		2	3					1	1	2	12
Sloops	1			1					1				3
Steamers	13	14	13	24	12	3				5	5	7	96
Steamships	1				1								2
Unknown			1	2						1	2		6
Total	33	54	43	128	111	9			7	21	31	33	470

TABLE 32.—*Abstract of returns of disasters to* FOREIGN VESSELS *on the* GREAT LAKES *during the year ending June* 30, 1878, *showing* NATIONALITY *and* DESCRIPTION, *and distinguishing those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Nationality and rig.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Aggregate.
British steamers		1		2		1		1		1																6	6
British schooners						1	1	2	1	1												1		2	2	7	9
British barge								1																		1	1
Total		1		2		2	1	4	1	2												1		2	2	14	16
Aggregate	1		2		2		5		3		....		....		....		....		....		1		2		16		

TABLE 33.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the* TONNAGE *and distinguishing the number of those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Burden of vessels.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
Not exceeding 50 tons	2	6		4	1	2	3	3	2	4		8								2		1		2	8	27	35
Over 50 and not exceeding 100 tons		5	1	6	1	3	4	10	6	9		1						1		2	1			2	13	39	52
Over 100 and not exceeding 200 tons	1	5		7	1	5		13	9	14							1	2		1		3	1	3	13	53	66
Over 200 and not exceeding 300 tons		6	1	11	3	10	4	28	2	23								2	1	7		10		6	11	103	114
Over 300 and not exceeding 400 tons		2		9	1	5	3	21	4	19	1											2	1	4	10	62	72
Over 400 and not exceeding 500 tons		2	1	2		4	1	6	1	4										2			1	1	4	21	25
Over 500 and not exceeding 600 tons		1	1	5				5		6		1								2		2			1	22	23
Over 600 and not exceeding 700 tons				1		2	1	3		3		1												2	1	12	13
Over 700 and not exceeding 800 tons		1		1		1		5		2		1										4		2		17	17
Over 800 and not exceeding 900 tons				1				2														1		2		6	6
Over 900 and not exceeding 1,000 tons								1												1		1				3	3
Over 1,000 and not exceeding 1,100 tons		1				1		2														1				5	5
Over 1,100 and not exceeding 1,200 tons		1		1				2		1													1		1	5	6
Over 1,200 and not exceeding 1,300 tons						1														1						2	2
Over 1,300 and not exceeding 1,400 tons						1																				1	1
Over 1,400 tons								3		1												1				5	5
Unknown				2		1		8		1		1					1			2		4		5	1	24	25
Total	3	30	4	50	7	36	16	112	24	87	1	8					2	5	1	20	1	30	4	29	63	407	470
Aggregate	33		54		48		128		111		9						7		21		31		33		470		

NOTE.—In the columns of "Partial loss" in this table are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 26.

TABLE 34.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the number of vessels and distinguishing* AGE.

Age.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Not exceeding 3 years	8	2	1	7	8	1	....	....	....	....	1	1	29
Over 3 and not exceeding 7 years	6	17	12	26	24	2	....	....	1	11	10	7	116
Over 7 and not exceeding 10 years	5	10	10	28	20	2	....	....	....	2	4	4	85
Over 10 and not exceeding 14 years	9	11	8	25	20	2	....	....	3	8	5	5	91
Over 14 and not exceeding 20 years	1	7	5	15	20	....	....	....	....	....	7	7	62
Over 20 and not exceeding 25 years	1	4	3	12	13	1	....	....	1	2	....	3	40
Over 25 and not exceeding 30 years	1	....	....	3	4	....	....	....	1	1	....	2	12
Over 30 and not exceeding 35 years	....	....	....	2	1	....	....	....	....	....	....	....	3
Over 35 and not exceeding 40 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 40 and not exceeding 45 years	....	....	1	....	....	....	....	....	....	....	....	....	1
Over 45 and not exceeding 50 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Over 50 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Unknown	2	3	3	10	1	1	....	....	1	2	4	4	31
Total	33	54	43	128	111	9	....	....	7	21	31	33	470

TABLE 35.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* CARGOES.

Cargoes.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Assorted	....	....	....	....	....	....	....	....	....	....	....	1	1
Ballast	13	19	14	17	17	4	....	....	5	6	11	8	114
Coal	3	9	6	18	11	....	....	....	....	1	2	3	53
Copper, &c	....	....	....	1	....	....	....	....	....	....	....	....	1
Fish	....	1	....	....	....	....	....	....	....	1	....	....	2
Fruit	1	....	....	4	....	....	....	....	....	....	....	....	5
Flour, &c	....	....	1	....	1	....	....	....	....	....	....	....	2
Grindstones	....	....	....	....	1	....	....	....	....	....	....	....	1
Grain	4	8	8	25	18	2	....	....	....	4	5	8	82
Hardware	....	....	....	1	....	....	....	....	....	....	....	....	1
Hay, &c	....	....	....	....	3	....	....	....	....	....	....	....	3
Iron, iron-ore, &c	....	4	3	6	8	....	....	....	....	....	1	1	23
Ice	....	....	....	....	....	....	....	....	1	....	....	....	1
Lime	....	3	....	....	1	....	....	....	....	....	....	....	4
Lumber, timber, &c	6	7	5	29	34	....	....	....	....	....	5	3	89
Laths, sand, plaster, &c	1	....	....	1	....	....	....	....	....	1	....	....	3
Merchandise	1	....	2	5	4	....	....	....	....	2	1	....	15
Miscellaneous	....	1	2	2	....	....	....	....	....	2	....	....	7
Railroad-ties	....	....	....	....	2	....	....	....	....	....	....	....	2
Shingles, &c	....	....	....	....	3	1	....	....	....	....	....	....	4
Stone, &c	....	....	....	1	1	....	....	....	....	....	....	1	3
Staves, &c	....	....	....	3	....	....	....	....	....	1	....	....	4
Salt, &c	....	....	1	2	2	....	....	....	....	....	1	....	6
Tan-bark	2	....	....	1	1	....	....	....	....	....	....	....	4
Wood	1	....	....	5	3	1	....	....	....	1	1	3	15
Unknown	1	2	1	7	1	1	....	....	1	2	4	5	25
Total	33	54	43	128	111	9	....	....	7	21	31	33	470

TABLE 36.—*Abstract of returns of disasters to vessels on the* GREAT LAKES *during the year ending June 30, 1878, showing the number of vessels and distinguishing the* LAKES *and* CONNECTING RIVERS *on which they occurred.*

Localities.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Lake Superior	1	2	1	....	2	....	....	....	....	....	....	1	7
Lake Michigan	13	21	19	48	55	5	....	....	5	11	18	12	207
Lake Huron	7	5	5	22	22	....	....	....	....	2	....	3	66
Lake Saint Clair	....	5	1	....	2	1	....	....	....	....	....	2	11
Lake Erie	4	11	5	39	13	....	....	....	....	6	2	1	81
Lake Ontario	3	7	5	4	11	2	....	....	....	....	....	3	35
Lake Champlain	....	....	1	....	....	....	....	....	....	....	....	....	1
Saint Clair River	2	....	3	4	3	1	....	....	2	....	2	7	24
Saint Mary's River	....	....	1	1	....	....	....	....	....	....	1	....	3
Straits of Mackinac	....	....	....	3	....	....	....	....	....	....	1	1	5
Detroit River	3	....	2	6	1	....	....	....	....	2	5	3	22
Welland Canal	....	3	....	1	2	....	....	....	....	....	2	....	8
Total	33	54	43	128	111	9	....	....	7	21	31	33	470

TABLE 37.—*Summary*—GREAT LAKES.

Nature of casualties.	Number of vessels.	Total number of tons.	Laden.	Ballast.	Unknown whether laden or not.	Total loss.	Partial and unknown loss.	Number of passengers.	Number of crew.	Total on board.	Total number of lives lost.
Founderings	10	2, 291	10	......	......	9	1	2	71	73	21
Strandings	107	30, 353	85	22	......	29	78	131	841	972	14
Vessels collided	150	51, 495	83	44	23	9	141	214	1, 241	1, 455	3
Other causes	203	60, 210	154	48	1	16	187	171	1, 638	1, 809	4
Total	470	144, 349	332	114	24	63	*407	518	3, 791	4, 309	42

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 26.

RIVERS.

TABLE 38.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June 30, 1878, showing the* NUMBER *and* VALUE OF VESSELS *and* CARGOES, *and the amount of* LOSS *to same, where known.*

Months.	Total value of vessels.		Number of vessels value unknown.	Total value of cargoes.		Number of cargoes value unknown.	Loss to vessels.		Number of vessels totally lost, amount unknown.	Number of vessels damaged, amount unknown.	Loss to cargoes.		Number of cargoes totally lost, amount unknown.	Number of cargoes not damaged, or damage unknown.
	Number.	Amount.		Number.	Amount.		Number.	Amount.			Number.	Amount.		
July	12	$269, 050	2	8	$153, 600	2	11	$60, 370	......	3	4	$65, 060	......	6
August	7	62, 100	....	4	25, 500	....	7	27, 353	......	......	2	2, 300	......	2
September	11	308, 600	....	7	14, 425	....	11	185, 000	......	......	1	3, 000	......	6
October	18	334, 600	1	15	213, 830	1	17	58, 370	......	2	4	44, 180	......	12
November	18	224, 150	....	10	107, 400	1	17	60, 782	......	1	8	58, 275	......	3
December	13	442, 000	....	8	96, 375	....	13	70, 685	......	......	4	83, 737	......	4
January	2	1, 000	....	1	300	....	2	300	......	......	1	75	......	......
February	5	68, 200	....	4	153, 000	....	5	36, 315	......	.....	2	63, 300	......	2
March	10	126, 900	2	5	166, 950	1	10	84, 102	......	2	5	77, 125	......	1
April	8	88, 000	....	6	103, 900	...	7	35, 850	......	1	4	96, 125	......	2
May	8	133, 400	....	3	19, 700	1	6	34, 130	......	2	1	700	......	3
June	4	30, 500	....	3	1, 060	....	3	375	......	1	....	....	......	3
Total	116	2, 088, 500	5	74	1, 056, 040	6	109	653, 132	......	*12	36	493, 877	......	44

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 39.

TABLE 39.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June 30, 1878, showing the number of vessels* TOTALLY LOST, *the number* DAMAGED, *aggregate* TONNAGE *of vessels* TOTALLY LOST, *the number of* PASSENGERS *and* CREW, *and number of* LIVES LOST.

Months.	Number of disasters resulting in total loss to vessels.	Number of disasters resulting in partial damage to vessels.	Whether total or partial loss unknown.	Number of casualties resulting in no damage to vessels.	Total.	Total tons burden of vessels totally lost.	Total number of crew, including master, &c.	Total number of passengers.	Total number of lives lost.
July	5	6	2	1	14	1,455	158	114	....
August	3	4	....	....	7	372	111	135	....
September	2	9	....	....	11	2,786	97	53	....
October	3	14	1	1	19	1,581	256	199	1
November	7	10	....	1	18	3,423	240	160	....
December	3	10	....	....	13	688	158	138	15
January	1	1	....	....	2	7	5	4	....
February	2	3	....	....	5	1,068	145	121	6
March	2	8	1	1	12	546	258	120	7
April	3	4	....	1	8	21	96	22	2
May	3	3	....	2	8	789	99	22	4
June	....	3	....	1	4	....	20	32	....
Total	34	75	4	8	121	12,736	1,643	1,120	35

TABLE 40.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June 30, 1878, showing the number of* VESSELS *and* CARGOES INSURED *and* UNINSURED, *and the* AMOUNT OF INSURANCE, *where known.*

Months.	Number of vessels and cargoes reported to be insured, and the amount of insurance.					Number of vessels and cargoes reported not insured.		Number of vessels and cargoes, whether insured or not unknown.		Vessels in ballast.
	Vessels.		Cargoes.		Total amount of insurance.					
	Number.	Amount.	Number.	Amount.		Vessels.	Cargoes.	Vessels.	Cargoes.	
July	4	$206,500	3	$92,000	$298,500	8	4	2	3	4
August	3	16,000	1	1,800	17,800	4	1	....	2	3
September	6	76,350	4	7,000	83,350	5	....	....	3	4
October	7	123,800	6	149,200	273,000	11	6	1	4	3
November	8	28,300	3	25,700	54,000	10	4	....	4	7
December	5	64,000	3	85,600	149,600	8	4	....	1	5
January	....	....	....	....	....	2	1	....	....	1
February	2	16,000	2	130,000	146,000	3	2	....	....	1
March	4	42,666	3	126,000	168,666	7	2	1	1	6
April	4	24,300	3	96,000	120,300	4	3	....	....	2
May	5	52,000	....	....	52,000	3	2	....	2	4
June	2	6,800	1	600	7,400	2	2	....	....	1
Total	50	656,716	29	713,900	1,370,616	67	31	4	20	41

TABLE 41.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June 30, 1878, distinguishing the* NATURE *of each casualty.*

Months.	Foundered.	Stranded.	Collided.	Capsized.	Damaged masts.	Explosion.	Fire.	Lightning.	Snagged, &c.	Total.
July	1	3	6	......	1	......	2	......	1	14
August	......	3	......	1	......	......	2	......	1	7
September	......	2	2	......	1	......	3	1	2	11
October	......	3	8	......	3	......	1	......	4	19
November	1	5	2	......	1	......	4	......	5	18
December	......	2	6	......	......	......	4	......	1	13
January	1	1	......	......	......	......	......	......	......	2
February	......	2	......	......	......	......	......	......	3	5
March	......	1	6	......	......	......	3	......	2	12
April	......	3	2	......	......	......	1	......	2	8
May	......	......	4	......	......	1	2	......	1	8
June	......	1	2	......	......	......	......	......	1	4
Total	3	26	38	1	6	1	22	1	23	121

TABLE 42.—*Abstract of returns of disasters (excluding collisions) to vessels and cargoes on the* RIVERS *of the United States during the year ending June 30, 1878, distinguishing the* CAUSE *of each disaster.*

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 1.—*Causes connected with the weather:*					
Gales, hurricanes, &c	......	6	7	......	13
Calms and currents	......	3	1	......	4
Lightning	......	......	1	......	1
Total of Class 1	......	9	9	......	18
CLASS 2.—*Causes connected with vessels, equipments, or stowage:*					
Defective hull, masts, rigging, &c	......	......	1	......	1
Total of Class 2	......	......	1	......	1
CLASS 3.—*Causes connected with navigation and seamanship:*					
Error of masters, officers, or crews	......	3	......	......	3
Error of pilot	......	3	......	......	3
Total of Class 3	......	6	......	......	6
CLASS 4.—*Causes connected with machinery and boilers:*					
Explosion of boiler	......	......	1	......	1
Total of Class 4	......	......	1	......	1
CLASS 5.—*Other causes:*					
Accidental	......	2	......	......	2
Fire	......	......	19	......	19
Absence of buoy	......	1	......	......	1
Incendiarism	......	......	2	......	2
Sprung a leak	3	......	1	......	4
Struck sunken rock, snag, &c	......	3	20	......	23
Miscellaneous	......	3	1	......	4
Unknown	......	2	......	......	2
Total of Class 5	3	11	43	......	57
Aggregate	3	26	54	......	83

TABLE 43.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *showing the number of vessels* COLLIDED *and distinguishing the* CAUSE *of each disaster.*

Months.	Accidental.	Adverse currents.	Bad management.	Carelessness.	Error in judgment.	Fault of tug-towing.	"Fault of other vessel."	Freshet.	Narrow channel.	Negligence.	Thick and foggy weather.	Total.
July	2		2				2					6
August												
September					2							2
October	2					4		2				8
November										2		2
December		2		2							2	6
January												
February												
March			2	2			2					6
April									2			2
May	2					2						4
June				2								2
Total	6	2	4	6	2	6	4	2	2	2	2	38

TABLE 44.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* DESCRIPTION.

Description of vessels.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Barges	1			1	1				1		1		5
Barks				1							1		2
Brig				1									1
Canal-boats	1				1								2
Schooners	4	3	6	5	6	3	2		1	5	3	1	39
Scow												1	1
Sloops				1		1		1	1				4
Steamers	6	4	5	10	10	8		4	8	3	3	2	63
Steamships						1							1
Unknown	2								1				3
Total	14	7	11	19	18	13	2	5	12	8	8	4	121

TABLE 45.—*Abstract of returns of disasters to foreign vessels on the* RIVERS *of the United States during the year ending June 30, 1878, showing* NATIONALITY *and* DESCRIPTION *and distinguishing those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Nationality and rig.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
British bark								1																		1	1
Total								1																		1	1
Aggregate							1																		1		

TABLE 46.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *showing the* TONNAGE *and distinguishing the number of those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Burden of vessels.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		Aggregate.
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	
Not exceeding 50 tons	1	3	1	1		2	1	4	4	1	1		1	1		1		5	1	3					10	21	31
Over 50 and not exceeding 100 tons			1					1		2		2				1						1		3	1	10	11
Over 100 and not exceeding 200 tons	2	1		1	1	2			1	2		2						1			1			1	5	10	15
Over 200 and not exceeding 300 tons	1	3	1			3		6		3	1	3				1		1	1		1	1			5	21	26
Over 300 and not exceeding 400 tons				1			1			1	1	2							1		1				4	4	8
Over 400 and not exceeding 500 tons						1		2							1			1							1	4	5
Over 500 and not exceeding 600 tons				1						1							1	1		2		1			1	6	7
Over 600 and not exceeding 700 tons															1			1				1			1	2	3
Over 700 and not exceeding 800 tons																	1								1		1
Over 800 and not exceeding 900 tons	1					1		2		1															1	4	5
Over 900 and not exceeding 1,000 tons																											
Over 1,000 and not exceeding 1,100 tons																											
Over 1,100 and not exceeding 1,200 tons																											
Over 1,200 and not exceeding 1,300 tons							1					1										1			1	2	3
Over 1,300 and not exceeding 1,400 tons																											
Over 1,400 tons		1			1			1	2																3	2	5
Unknown		1																								1	1
Total	5	9	3	4	2	9	3	16	7	11	3	10	1	1	2	3	2	10	3	5	3	5		4	34	87	121
Aggregate	14		7		11		19		18		13		2		5		12		8		8		4		121		...

NOTE.—In the columns of "Partial loss," in this table, are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 39.

TABLE 47.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *showing the number of vessels and distinguishing* AGE.

Age.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Not exceeding 3 years	5	....	1	5	3	3	....	2	3	1	1	....	24
Over 3 and not exceeding 7 years	2	3	2	3	5	....	1	1	....	4	....	1	22
Over 7 and not exceeding 10 years	2	2	3	6	2	3	1	1	4	....	2	....	26
Over 10 and not exceeding 14 years	1	1	3	2	6	3	....	....	....	2	4	....	22
Over 14 and not exceeding 20 years	1	....	....	1	1	1	....	1	....	....	....	1	6
Over 20 and not exceeding 25 years	....	....	....	....	....	....	....	....	....	1	....	2	3
Over 25 and not exceeding 30 years	....	....	1	....	....	1	....	....	....	....	1	....	3
Over 30 and not exceeding 35 years	1	....	1	....	....	....	....	....	....	....	....	....	2
Over 35 and not exceeding 40 years	....	....	....	....	....	1	....	....	....	....	....	....	1
Over 40 and not exceeding 45 years	....	....	....	1	....	....	....	....	....	....	....	....	1
Over 45 and not exceeding 50 years	....	....	....	....	1	....	....	....	....	....	....	....	1
Over 50 years	....	....	....	....	....	....	....	....	....	....	....	....	....
Unknown	2	1	....	1	....	1	....	....	5	....	....	....	10
Total	14	7	11	19	18	13	2	5	12	8	8	4	121

TABLE 48.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* CARGOES.

Cargoes.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Ballast	4	3	4	3	7	5	1	1	6	2	4	1	41
Coal	1	1	1	1	2	2	....	....	....	1	....	1	10
Cotton, rice, &c	....	....	....	2	1	2	....	2	2	....	....	....	9
Fertilizers	....	....	....	1	....	....	....	....	....	....	....	....	1
Fish	....	....	....	....	....	....	....	....	....	1	....	....	1
Flour	....	....	....	3	....	....	....	....	....	....	....	....	3
Furniture	....	....	....	....	....	1	....	....	....	....	....	....	1
Grain, &c	1	2	....	1	1	....	....	....	1	....	....	....	6
Ice	....	....	....	....	1	....	....	....	....	1	....	....	2
Iron and iron-ore	....	....	1	1	....	....	....	....	....	....	....	....	2
Lime	....	....	....	....	....	1	....	....	....	....	1	....	2
Live stock, &c	....	....	....	1	....	....	....	....	....	1	....	....	2
Lumber, &c	1	....	1	1	1	....	....	1	....	....	1	....	6
Merchandise	2	....	1	2	2	....	....	....	1	1	2	1	12
Miscellaneous	1	....	....	....	2	....	1	....	1	1	....	1	7
Phosphate rock	....	....	....	2	....	....	....	....	....	....	....	....	2
Produce	....	....	....	....	1	1	....	1	....	....	....	....	3
Railroad-iron	1	1	....	....	....	....	....	....	....	....	....	....	2
Shingles	....	....	2	....	....	....	....	....	....	....	....	....	2
Stone	....	....	1	....	....	....	....	....	....	....	....	....	1
Wood, hoops, &c	1	....	....	....	....	1	....	....	....	....	....	....	2
Unknown	2	....	....	1	....	....	....	....	1	....	....	....	4
Total	14	7	11	19	18	13	2	5	12	8	8	4	121

TABLE 49.—*Abstract of returns of disasters to vessels on the* RIVERS *of the United States during the year ending June* 30, 1878, *distinguishing the* RIVERS *on which they occurred.*

Rivers.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Arkansas	1												1
Ashley (South Carolina)				2									2
Atchafalaya (Louisiana)								1					1
Cape Fear (North Carolina)		1	1									2	4
Chattahoochee (Alabama)				1	1								2
Cumberland (Kentucky)								1					1
Delaware	3		2	1	4	2					2		14
Hudson	6		2		1	2				1			12
James	1				1								2
Kennebec (Maine)					1					1			2
Kentucky								1					1
Merrimac												1	1
Mississippi	1	1		2	4	2			7	1	1		19
Missouri	1		1										2
Nansemond (Virginia)										1			1
Neuse (North Carolina)				1		1	2						4
North (North Carolina)										2			2
Northwest (Virginia)				1									1
Ohio		1							1		1		3
Potomac				3	2	4			2				11
Rappahannock (Virginia)											1		1
Red (Louisiana)	1							1		1			3
Sacramento			1	3	1	2		1					8
Saginaw (Michigan)			1		1						2	1	5
Saint John's (Florida)		1			1						1		3
Saint Lawrence		2	2	2	1								7
Sandy (South Carolina)			1										1
Savannah (Georgia)				1									1
Schuylkill (Pennsylvania)				2									2
Susquehanna (Pennsylvania)		1											1
Taunton (Massachusetts)										1			1
Tennessee									1				1
Trinity (Texas)									1				1
Total	14	7	11	19	18	13	2	5	12	8	8	4	121

TABLE 50.—*Summary*—RIVERS.

Nature of casualties.	Number of vessels.	Total number of tons.	Laden.	Ballast.	Unknown whether laden or not.	Total loss.	Partial and unknown loss.	Number of passengers.	Number of crew.	Total on board.	Number of lives lost.
Founderings	3	105	1	2		1	2	4	11	15	
Strandings	26	6, 454	22	4		7	19	164	277	441	
Vessels collided	38	11, 043	20	14	4	3	35	270	351	621	5
Other causes	54	20, 559	33	21		23	31	682	1, 004	1, 686	30
Total	121	38, 161	76	41	4	34	*87	1, 120	1, 643	2, 763	35

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 39.

AT SEA OR IN FOREIGN WATERS.

TABLE 51.—*Abstract of returns of disasters to American* vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *showing the number and* VALUE *of* VESSELS *and* CARGOES *and amount of* LOSS *to same where known.*

Months.	Total value of vessels.		Number of vessels value unknown.	Total value of cargoes.		Number of cargoes value unknown.	Loss to vessels.		Number of vessels totally lost amount unknown.	Number of vessels damaged amount unknown.	Loss to cargoes.		Number of cargoes totally lost, amount unknown.	Number of cargoes not damaged, or damage unknown.
	Number.	Amount.		Number.	Amount.		Number.	Amount.			Number.	Amount.		
July	17	$681, 550	3	15	$499, 595	3	17	$89, 066	....	3	7	$10, 045	....	11
August	15	420, 988	....	12	156, 569	2	15	233, 760	....	....	5	20, 860	....	9
September	28	418, 017	....	27	876, 200	....	28	211, 500	....	....	12	333, 725	....	15
October	37	807, 000	3	35	816, 360	3	37	393, 900	....	3	19	236, 560	....	19
November	49	799, 000	6	43	635, 663	10	49	433, 765	....	6	27	233, 813	....	26
December	55	1, 041, 000	1	48	1, 527, 765	4	53	263, 407	....	3	27	443, 017	....	25
January	47	1, 116, 483	3	41	2, 270, 541	3	46	375, 568	....	4	25	263, 578	....	19
February	48	1, 471, 100	1	41	1, 659, 252	4	45	815, 100	....	4	21	709, 722	....	24
March	23	331, 200	2	21	203, 761	3	22	161, 525	....	3	12	26, 094	....	12
April	31	338, 100	1	18	289, 000	4	29	95, 879	....	3	11	68, 700	....	11
May	22	579, 900	3	20	462, 230	4	21	78, 050	....	4	11	89, 340	....	13
June	14	157, 000	2	13	379, 700	2	14	59, 350	....	2	9	46, 199	....	6
Total	386	8, 161, 338	25	334	9, 776, 636	42	376	3, 210, 870	....	†35	186	2, 481, 653	....	190

* In the totals of casualties presented in the following thirteen tables are included, in order to show the whole number of vessels in collision, eleven foreign vessels which have collided with American vessels at sea or in foreign waters during the year.

† In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 52.

TABLE 52.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *showing the number of vessels* TOTALLY LOST, *the number* DAMAGED, *aggregate* TONNAGE *of vessels* TOTALLY LOST, *number of* PASSENGERS *and* CREW, *and number of* LIVES LOST.

Months.	Number of disasters resulting in total loss to vessels.	Number of disasters resulting in partial damage to vessels.	Whether total or partial loss unknown.	Number of casualties resulting in no damage to vessels.	Total.	Total tons burden of vessels totally lost.	Total number of crew, including master, &c.	Total number of passengers.	Total number of lives lost.
July	6	11	3	....	20	785	267	105	....
August	5	10	....	....	15	2, 783	237	28	18
September	10	18	....	....	28	4, 024	357	5	10
October	10	27	2	1	40	6, 147	448	37	2
November	24	25	6	....	55	10, 357	537	2	29
December	16	37	1	2	56	4, 959	476	11	27
January	20	26	3	1	50	8, 443	526	14	60
February	12	33	1	3	49	8, 533	620	23	36
March	7	15	3	....	25	2, 462	237	3	....
April	9	20	2	1	32	1, 735	311	6	15
May	6	15	4	....	25	1, 022	272	88	....
June	3	11	2	....	16	757	125	71	2
Total	128	248	27	8	411	52, 007	4, 413	893	199

TABLE 53.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *showing the number of* VESSELS *and* CARGOES INSURED *and* UNINSURED, *and the* AMOUNT OF INSURANCE, *where known.*

Months.	Number of vessels and cargoes reported to be insured, and the amount of insurance. — Vessels. — Number.	Vessels. — Amount.	Cargoes. — Number.	Cargoes. — Amount.	Total amount of insurance.	Number of vessels and cargoes reported not insured. — Vessels.	Not insured — Cargoes.	Number of vessels and cargoes, whether insured or not, unknown. — Vessels.	Unknown — Cargoes.	Vessels in ballast.
July	14	$480, 800	7	$375, 000	$855, 800	6	5	....	6	2
August	10	190, 315	9	140, 469	330, 784	5	2	....	3	1
September	18	188, 419	17	639, 725	828, 144	10	5	....	5	1
October	24	241, 000	16	586, 371	827, 371	11	10	5	12	2
November	34	361, 433	24	550, 149	911, 582	14	13	7	16	2
December	45	346, 000	29	854, 229	1, 200, 229	9	8	2	15	4
January	27	362, 500	28	921, 435	1, 283, 935	19	4	4	12	6
February	34	601, 950	22	898, 000	1, 499, 950	13	7	2	16	4
March	18	121, 350	13	168, 408	289, 758	5	3	2	8	1
April	21	184, 278	11	136, 700	320, 978	10	6	1	5	10
May	11	303, 900	6	150, 650	454, 550	9	10	5	8	1
June	10	73, 850	11	248, 000	321, 850	4	2	2	2	1
Total	266	3, 455, 795	193	5, 669, 136	9, 124, 931	115	75	30	108	35

TABLE 54.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *distinguishing the* NATURE *of each casualty.*

Nature of casualties.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Foundered	1	3	5	3	5	3	6	2	1	4	....	1	34
Stranded	5	1	6	6	9	9	4	7	6	3	6	2	64
Collided	6	6	....	6	14	2	6	4	4	6	6	4	64
Capsized	1	....	....	....	2	1	....	1	....	2	....	....	7
Dismasted, &c	....	....	3	1	2	4	1	3	1	2	....	1	18
Damaged sails, rigging, &c	3	1	9	14	9	15	16	16	7	9	5	1	105
Damaged machinery	2	....	....	....	....	....	1	....	....	....	....	....	3
Abandoned	1	....	2	1	....	1	3	3	....	....	1	....	12
Fire	....	....	....	2	....	4	....	1	1	....	....	....	8
Ice	....	1	....	....	....	....	....	....	....	....	....	....	1
Miscellaneous	....	....	1	1	1	3	....	1	1	....	....	....	8
Lost deck-load, &c	....	....	....	1	2	3	1	3	1	1	1	1	14
Bilged and went to pieces	....	....	....	....	1	....	1	....	....	....	....	....	2
Never heard from	....	1	....	....	1	1	3	....	....	1	....	....	7
Sprung a leak	1	2	2	4	9	9	6	5	2	4	6	4	54
Struck sunken wreck	....	....	....	....	....	....	....	1	....	....	....	....	1
Struck by lightning	....	....	....	....	....	....	....	1	....	....	....	1	2
Water-logged	....	....	....	....	....	....	....	....	1	....	....	1	2
Unknown	....	....	....	1	....	1	2	1	....	....	....	....	5
Total	20	15	28	40	55	56	50	49	25	32	25	16	411

TABLE 55.—*Abstract of returns of disasters (excluding collisions) to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June 30, 1878, and distinguishing the* CAUSE *of each disaster.*

Class and cause of disaster.	Founderings.	Strandings.	Other causes.	Missing vessels.	Total.
CLASS 1.—*Causes connected with the weather:*					
Gales, hurricanes, &c	28	31	148	......	207
Calms, currents, and tides	......	9	2	......	11
Heavy seas	......	4	47	......	51
Fog, &c	......	4	......	......	4
Lightning	......	......	2	......	2
Darkness	......	2	1	......	3
Total of class 1	28	50	200	......	278
CLASS 2.—*Causes connected with vessels, equipments, or stowage:*					
Defective hull, masts, rigging, &c	......	......	3	......	3
Error in compass or chronometer	......	2	......	......	2
Total of class 2	......	2	3	......	5
CLASS 3.—*Causes connected with navigation and seamanship:*					
Error of masters, officers, or crew	......	3	1	......	4
Error of pilot	......	3	......	......	3
Total of class 3	......	6	1	......	7
CLASS 4.—*Causes connected with machinery or boilers:*					
Damage to machinery	......	......	3	......	3
Total of class 4	......	......	3	......	3
CLASS 5.—*Other causes:*					
Accidental	......	......	2	......	2
Fire	......	......	5	......	5
Incendiarism	......	......	1	......	1
Ice	......	......	2	......	2
Sprung a leak	4	1	10	......	15
Struck sunken wreck or rock	......	1	1	......	2
Miscellaneous	......	2	6	......	8
Unknown	2	2	7	8	19
Total of class 5	6	6	34	8	54
Aggregate	34	64	241	8	347

TABLE 56.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June 30, 1878, showing the number of vessels* COLLIDED *and distinguishing the* CAUSE *of each disaster.*

Cause of disaster.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Thick and foggy weather	2	4	....	2	2	....	....	....	....	....	....	2	12
Fault of pilot	2	....	....	....	....	....	2	....	....	....	....	....	4
Darkness	2	....	....	....	....	....	....	2	....	4	2	....	10
Carelessness	....	2	....	....	2	....	....	....	....	....	2	....	6
High winds	....	....	....	2	4	....	....	....	....	....	....	....	6
"Fault of other vessel"	....	....	....	2	....	2	4	....	....	....	....	2	10
Stress of weather	....	....	....	....	2	....	....	....	....	....	....	....	2
Dragged anchors	....	....	....	....	2	....	....	....	....	....	....	....	2
Misunderstanding signals	....	....	....	....	....	....	....	2	....	....	....	....	2
Fault of tug towing	....	....	....	....	....	....	....	....	2	....	....	....	2
Heavy sea	....	....	....	....	....	....	....	....	2	....	....	....	2
Unknown	....	....	....	....	2	....	....	....	....	2	2	....	6
Total	6	6	....	6	14	2	6	4	4	6	6	4	64

TABLE 57.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *showing the number of vessels and distinguishing their* DESCRIPTION.

Description of vessels.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Barks	3	3	8	8	13	3	4	7	3	5	2	3	62
Barkentines	....	....	....	1	3	1	2	4	....	....	....	....	11
Brigs	1	....	3	4	6	8	3	5	7	1	5	2	45
Brigantines	....	....	....	....	....	1	....	1	....	....	....	1	3
Schooners	11	8	14	21	23	36	29	20	13	22	11	8	216
Ships	2	2	2	5	6	5	7	8	1	2	2	1	43
Steamers	2	2	1	....	....	....	1	3	....	1	2	....	12
Steamships	....	....	....	....	....	2	2	....	....	....	1	....	5
Unknown	1	....	....	1	4	....	2	1	1	1	2	1	14
Total	20	15	28	40	55	56	50	49	25	32	25	16	411

TABLE 53.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June* 30, 1878, *showing the* TONNAGE *and distinguishing the number of those* TOTALLY LOST *and those* PARTIALLY DAMAGED.

Burden of vessels.	July.		August.		September.		October.		November.		December.		January.		February.		March.		April.		May.		June.		Total.		
	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Total loss.	Partial loss.	Aggregate.
Not exceeding 50 tons					1						3		2			1	1	1	1		1			1	9	3	12
Over 50 and not exceeding 100 tons	4	1	1	3		5		1	2	4	1	4	2	4		4		3	3	5	2	1	1	2	16	37	53
Over 100 and not exceeding 200 tons	1	3	1		1	3		10	5	4	1	10	4	7	1	4		2	2	7	1	4		2	17	56	73
Over 200 and not exceeding 300 tons		1	1	2	2	2	3	2	4	3	6	7	4	3	1	8	2	3		3	1	1	1		25	35	60
Over 300 and not exceeding 400 tons	1	2		1	3	1	1	4	5	2	2	7	2	2	6	2	2	1	2	3		4		3	24	32	56
Over 400 and not exceeding 500 tons					1	2	2	3	1	3		5	1	3		5	1	5	1	1		2	1	1	8	30	38
Over 500 and not exceeding 600 tons				1		1		2	4	2	1		1	2						1	1			1	7	10	17
Over 600 and not exceeding 700 tons			1		1		1	1		1						1								1	3	4	7
Over 700 and not exceeding 800 tons		1						1		1						2	1	1							1	6	7
Over 800 and not exceeding 900 tons				1						1	1	1	1			1								1	2	5	7
Over 900 and not exceeding 1,000 tons							1		1	1				1		2									2	4	6
Over 1,000 and not exceeding 1,100 tons		1		1		2	1	1		1	1		1	2											3	8	11
Over 1,100 and not exceeding 1,200 tons						1							1									1			1	2	3
Over 1,200 and not exceeding 1,300 tons		1			1	1		1	1			1			1	3									3	7	10
Over 1,300 and not exceeding 1,400 tons								1		2		3		1	1							1			1	8	9
Over 1,400 tons		2	1	1			1	1	1			2	1	2	2	3				2		2			6	15	21
Unknown		2						2		6				3		1		2		1		3		1		21	21
Total	6	14	5	10	10	18	10	30	24	31	16	40	20	30	12	37	7	18	9	23	6	19	3	13	128	283	411
Aggregate	20		15		28		40		55		56		50		49		25		32		25		16		411		

NOTE.—In the column of "Partial loss," in the table, are included the casualties in which the vessels sustained no damage, for the number of which see appropriate column in Table 52.

TABLE 59.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June 30, 1878, showing the number of vessels and distinguishing* AGE.

Age.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Not exceeding 3 years	4	3	2	8	4	14	6	8	4	4	2	....	59
Over 3 and not exceeding 7 years	2	6	4	7	7	9	12	8	4	9	2	4	74
Over 7 and not exceeding 10 years	3	1	7	5	10	11	5	3	2	6	2	3	58
Over 10 and not exceeding 14 years	2	1	2	9	15	16	9	12	8	6	8	4	92
Over 14 and not exceeding 20 years	3	1	4	3	1	2	4	4	2	2	1	2	29
Over 20 and not exceeding 25 years	2	1	3	1	6	3	6	7	1	2	5	2	39
Over 25 and not exceeding 30 years	1	1	1	3	4	....	3	2	....	1	....	....	16
Over 30 and not exceeding 35 years	....	....	1	....	1	....	....	....	1	1	....	....	4
Over 35 and not exceeding 40 years	....	....	1	....	....	....	....	1	....	....	1	....	3
Over 40 and not exceeding 45 years	....	....	1	1	....	....	....	....	....	....	....	....	2
Over 45 and not exceeding 50 years	....	....	....	....	....	....	....	....	1	....	....	....	1
Over 50 years	....	1	....	....	....	....	....	1	....	....	....	....	2
Unknown	3	....	2	3	7	1	5	3	2	1	4	1	32
Total	20	15	28	40	55	56	50	49	25	32	25	16	411

TABLE 60.—*Abstract of returns of disasters to American vessels* AT SEA *or in* FOREIGN WATERS *during the year ending June 30, 1878, showing the number of vessels and distinguishing their* CARGOES.

Cargoes.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Assorted	....	....	....	....	1	....	1	1	....	....	....	1	4
Barrels, shooks, staves, &c	....	....	....	....	1	2	1	....	1	....	....	....	5
Ballast	2	1	1	2	2	4	6	4	1	10	1	1	35
Breadstuffs	....	....	1	....	....	....	....	....	....	....	....	....	1
Bricks, lime, &c	....	....	....	1	....	....	....	....	....	1	1	....	3
Chalk	....	....	....	....	....	1	....	....	....	....	....	....	1
Cotton, &c	2	1	1	....	....	1	2	2	2	....	....	1	12
Coal	3	1	3	6	6	4	6	7	3	2	2	....	43
Coffee, rice, &c	....	....	2	....	....	2	1	....	....	....	....	....	5
Flour, &c	....	....	....	....	....	1	....	1	....	1	....	....	3
Fish and fishing outfits	3	4	3	....	3	....	2	2	2	3	2	1	25
Fruits, nuts, &c	1	....	....	1	2	2	....	1	1	....	1	....	9
Grain	....	....	1	5	2	1	....	2	....	....	....	1	12
Guano	....	....	2	....	1	5	3	1	1	....	3	1	17
Hemp, hides, wool, &c	....	1	....	....	1	....	....	....	1	....	....	....	3
Hay, &c	....	....	....	....	1	....	....	....	....	....	....	....	1
Iron, &c	1	....	1	....	....	3	....	....	....	....	....	....	5
Ice	....	....	....	....	....	....	1	....	....	....	2	....	3
Logwood, &c	....	....	1	1	3	5	2	2	....	1	....	....	15
Linseed, jute, &c	....	....	....	....	....	....	....	1	....	....	....	....	1
Lumber, timber, &c	1	1	4	10	8	5	4	11	2	2	1	2	51
Merchandise	1	4	1	....	3	6	5	4	3	5	2	1	35
Molasses, sugar, &c	....	....	2	2	4	8	3	3	1	3	3	4	33
Mercury, &c	1	....	....	....	....	....	....	....	....	....	....	....	1
Mahogany	....	....	1	2	....	....	....	....	....	....	1	....	4
Miscellaneous	1	....	....	....	....	2	....	....	....	1	....	....	4
Oil, whalebone, and ivory	....	1	2	3	3	1	2	1	2	1	....	....	16
Petroleum	....	....	....	....	1	....	1	1	1	1	....	....	5
Pearl, shells, &c	....	....	....	....	....	....	....	1	....	....	....	....	1
Phosphate rock	....	....	....	2	1	....	1	....	1	....	....	....	5
Provisions, &c	....	....	....	....	1	....	1	....	....	....	....	....	2
Rubber, &c	....	....	....	....	....	....	1	1	....	....	....	....	2
Railroad-ties	....	....	....	....	....	....	....	....	....	....	....	1	1
Slate	....	....	....	....	1	....	....	....	....	....	....	....	1
Stone, plaster, clay, cement, &c	....	1	1	....	1	1	....	....	1	....	2	....	7
Salt, tobacco, &c	....	....	1	....	2	1	3	1	....	....	1	....	9
Wood	1	....	....	1	....	....	....	....	....	....	....	....	2
Sperm oil	....	....	....	2	....	....	1	1	....	....	....	....	4
Unknown	3	....	....	2	7	1	3	1	2	1	3	2	25
Total	20	15	28	40	55	56	50	49	25	32	25	16	411

TABLE 61.—*Summary*—AT SEA *or in* FOREIGN WATERS.

Nature of casualties.	Number of vessels.	Total number of tons.	Laden.	Ballast.	Unknown whether laden or not.	Total loss.	Partial and unknown loss.	Number of passengers.	Number of crew.	Total on board.	Total number of lives lost.
Founderings	34	12,292	31	2	1	33	1	17	311	328	46
Strandings	64	25,544	54	10	......	49	15	24	759	783	6
Vessels collided	64	27,314	28	6	30	4	60	169	629	798	6
Other causes	249	109,027	221	17	11	42	207	183	2,714	2,897	141
Total	411	174,177	334	35	42	128	*283	393	4,413	4,806	199

* In this column are included the casualties in which no damage was sustained by the vessels, for the number of which see appropriate column in Table 52.

TABLE 62.—GENERAL SUMMARY.

Nature of casualties.	Number of vessels.	Aggregate tonnage.	Laden.	Ballast.	Unknown whether laden or not.	Wrecks involving total loss.	Casualties involving partial and unknown damage.	Number of passengers.	Number of crew.	Total on board.	Number of lives lost.
Founderings:											
Atlantic and Gulf coasts	46	4,618	32	14	....	34	12	3	186	189	6
Pacific coast	5	216	4	1	....	2	3	....	15	15	....
Great lakes	10	2,291	10	....	....	9	1	2	71	73	21
Rivers	3	105	1	2	....	1	2	4	11	15	....
At sea or in foreign waters	34	12,292	31	2	1	33	1	17	311	328	46
Total	98	19,522	78	19	1	79	19	26	594	620	73
Strandings:											
Atlantic and Gulf coasts	290	52,907	215	71	4	127	163	427	2,080	2,507	249
Pacific coast	41	11,707	30	11	....	19	22	90	352	442	6
Great lakes	107	30,353	85	22	....	29	78	131	841	972	14
Rivers	26	6,454	22	4	....	7	19	164	277	441	....
At sea or in foreign waters	64	25,544	54	10	....	49	15	24	759	783	6
Total	528	126,965	406	118	4	231	297	836	4,309	5,145	275
Vessels collided:											
Atlantic and Gulf coasts	300	79,605	173	84	43	15	285	3,623	2,474	6,097	20
Pacific coast	31	12,003	13	18	....	4	27	405	402	807	4
Great lakes	150	51,495	83	44	23	9	141	214	1,241	1,455	3
Rivers	38	11,043	20	14	4	3	35	270	351	621	5
At sea or in foreign waters	64	27,314	28	6	30	4	60	169	629	798	6
Total	583	181,460	317	166	100	35	548	4,681	5,097	9,778	38
Other causes:											
Atlantic and Gulf coasts	207	54,572	144	63	....	20	187	921	1,792	2,713	19
Pacific coast	20	6,339	18	2	....	4	16	279	206	485	18
Great lakes	203	60,210	154	48	1	16	187	171	1,638	1,809	4
Rivers	54	20,559	33	21	....	23	31	682	1,004	1,686	30
At sea or in foreign waters	249	100,027	221	17	11	42	207	183	2,714	2,897	141
Total	733	250,707	570	151	12	105	628	2,236	7,354	9,590	212
Grand total	1,942	578,654	1,371	454	117	450	1,492	7,779	17,354	25,133	*598

*In addition to the number of lives lost here reported, 87 lives were lost in cases where no other casualty occurred to the vessel, making the total number of lives lost 685.

RECAPITULATION.

Nature of casualties.	Number of vessels.	Aggregate tonnage.	Laden.	Ballast.	Unknown whether laden or not.	Wrecks involving total loss.	Casualties involving partial and unknown damage.	Number of passengers.	Number of crew.	Total on board.	Number of lives lost.
Atlantic and Gulf coasts	843	191, 702	564	232	47	196	647	4, 974	6, 532	11, 506	294
Pacific coast	97	30, 265	65	32	....	29	68	774	975	1, 749	28
Great lakes	470	144, 349	332	114	24	63	407	518	3, 791	4, 309	42
Rivers	121	38, 161	76	41	4	34	87	1, 120	1, 643	2, 763	35
At sea or in foreign waters	411	174, 177	334	35	42	128	283	393	4, 413	4, 806	199
Total	1, 942	578. 654	1, 371	454	117	450	1, 492	7, 779	17, 354	25, 133	*598

	Atlantic and Gulf coasts.	Pacific coast.	Great lakes.	Rivers.	At sea or in foreign waters.	Aggregate.
Total value vessels involved	$12, 781, 577	$2, 351, 850	$5, 901, 080	$2, 088, 500	$8, 161, 338	$31, 284, 345
Total value cargoes involved	5, 193, 563	985, 393	2, 782, 795	1, 056, 040	9, 776, 636	19, 794, 427
Aggregate	17, 975, 140	3, 337, 243	8, 683, 875	3, 144, 540	17, 937, 974	51, 078, 772
Total insurance on vessels	2, 307, 105	758, 700	2, 159, 580	656, 716	3, 455, 795	9, 337, 896
Total insurance on cargoes	2, 069, 626	107, 540	1, 831, 808	713, 900	5, 669, 136	10, 392, 010
Aggregate	4, 376, 731	866, 240	3, 991, 388	1, 370, 616	9, 124, 931	19, 729, 906
Total losses to vessels	2, 712, 968	372, 032	667, 214	653, 132	3, 210, 870	7, 616, 216
Total losses to cargoes	1, 036, 312	160, 059	301, 782	493, 877	2, 481, 653	4, 473, 683
Aggregate	3, 749, 280	532, 091	968, 996	1, 147, 009	5, 692, 523	12, 089, 899
Total tonnage vessels involved	191, 702	30, 265	144, 349	38, 161	174, 177	578, 654
Total tonnage vessels lost	35, 503	3, 590	13, 197	12, 736	52, 007	117, 033

* In addition to the number of lives lost here reported, 92 lives were lost in cases where no other casualty occurred to the vessels, making the total number of lives lost 690.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, and to American vessels at sea or in foreign waters, involving* LOSS OF LIFE, *during the year ending June 30, 1878, in four divisions, viz: (1) Founderings; (2) Strandings; (3) Collisions; and (4) Casualties from Other Causes; showing in each case, when known, the* DESCRIPTION *of the* VESSEL *and the* CARGO, *the number of* LIVES LOST, *and the* DATE *and* PLACE *of disaster, &c.*

(1) FOUNDERINGS.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tonnage.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.
1877. Aug. 3	C. J. Van Name	125469	American schooner	165	New York	Baracoa, Cuba	Total	Coal	3	Latitude 31°, longitude 74°.
Sept. 16	Alice Taylor	105259	do	49	Lake Charles, La.	Galveston, Tex	do	Lumber	7	At sea.
Oct. 4	Netta Weaver	18089	do	310	L'Anse, Mich	Detroit, Mich	do	Iron ore	2	Fifty-five miles north-northwest of Kincardine, Ontario, Lake Huron.
8	N. A. Farwell	18727	do	237	Bull's River, S. C.	Wood's Hole, Mass	do	Phosphate rock	2	Forty miles southeast by east from Barnegat, N. J.
10	Eliza R. Turner	8191	do	409	Detroit, Mich	Buffalo, N. Y	do	Wheat	2	Nine miles west of Long Point, Ontario, Lake Erie.
31	Young Hickory	27540	American steamer	61	Rondeau, Lake Erie.	Detroit, Mich	do	Wood	1	Off Clay Banks, Lake Erie.
Nov. 5	Madison Holmes	16857	American schooner	189	Progresso, Mexico.	Tampico, Mexico	do	Hemp	1	At sea.
8	Kate L. Bruce	14277	do	307	Chicago, Ill	Buffalo, N. Y	do	Wheat	8	Near Thunder Bay, Lake Huron.
9	Magellan		Canadian schooner	411	Chicago, Ill	Toronto	do	Corn	8	Off Two Rivers, Wis., Lake Michigan.
—	Pekin	20166	American bark	596	New York	Cardiff	do	Wheat	12	At sea.
Dec. 3	Josephine	12818	American schooner	93	do	Orient, L. I	do	Boneblack	3	Near Plum Gut, Long Island Sound.
3	Two Sisters	24879	do	18	Mermenteau, La	Galveston, Tex	do	Cotton and oranges	3	Near Galveston Island.
28	Three Sisters	145094	do	16	Pensacola, Fla	Apalachicola, Fla	do	Corn, flour, &c	2	At sea.
1878. Jan. —	Grace Darling	10708	American ship	1,042	Departure Bay, Vancouver Island, B. C.	San Francisco	do	Coal	18	At sea.
Apr. 5	John Zittlosen	75182	American bark	500	Cardiff, England.	Havana, Cuba	do	do	1	In Bahama Channel, twenty-five miles north of Sagua la Grande, Cuba.

Total: Vessels, 15; tons, 4,403; total losses, 15; partial losses, 0; lives lost, 73.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, &c.*—Continued.

(2) STRANDINGS.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tonnage.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.
1877. Sept. 23	Cricket	4047	American bark	405	Rio de Janeiro, Brazil.	Baltimore, Md	Total	Coffee	1	Near Cape Frio, sixty miles from Rio.
Oct. 4	Nicholas		German brig	250	Bremen	Charleston	do	Salt	3	North Breaker, Saint Helena Sound, S. C.
8	C. P. Williams	4364	American barge	292	Saginaw, Mich	Dunkirk, N. Y	do	Lumber	7	Pigeon Bay, near Leamington, Ontario, Lake Erie.
10	Lake Forest	15578	American schooner	332	Cleveland, Ohio	Chicago, Ill	Partial	Coal	1	Four miles southwest from Thunder Bay, Lake Huron.
26	Johannes	75127	do	90	San Francisco	Little River, Cal	Total	Ballast	1	Mouth of Little River, Cal.
Nov. 7	D. W. Powers	6767	American steamer	303	Buffalo, N. Y	Marquette, Mich	Partial	Coal	1	Four miles east of Detour Light, Sault Ste. Marie, Lake Huron.
8	Berlin	2161	American schooner	214	Marblehead, Ohio	Bay City, Mich	Total	Limestone	4	Burnt Cabin Point Reef, Lake Huron.
8	Ellen Stevens	8057	American bark	378	New York	Cette, France	do	Petroleum	1	Near Cette, France.
9	Ellen P. Stewart	7890	American brig	326	Ragged Island, W. I.	Philadelphia	do	Salt	1	Diamond Reef, off Cape Hatteras.
23	Fred. Eugene	120161	American barkentine.	470	Troon, Scotland	Matanzas, Cuba	do	Coal	2	Near Llanenddwyn Point, on Carnarvon Bar, North Wales.
24	Frank Jameson	9720	American schooner	181	Rockport, Me	Richmond, Va	do	Ice	5	Breakers off Smith's Island, Va.
24	Huron		U. S. naval steamer	610	Hampton Roads	Key West, Fla	do	Ballast	98	Nag's Head, N. C.
25	Ossipee	19207	American brig	364	Denia, Spain	New York	do	Nuts and raisins	2	Ten miles northwest of Chincoteague light-house.
Dec. 4	Agnes	1288	American schooner	202	Saint Domingo	Kingston, Jamaica	do	do	1	Morant Cays, W. I.
29	Wm. H. Prentice	80188	do	74	Jacksonville, Fla	do	do	Lumber	1	One hundred and thirty miles north of Watling's Island, Bahamas.
1878. Jan. 3	Frederick Fish	9579	do	239	Weehawken, N. J	Boston, Mass	do	Coal	1	Stone Horse Shoal, Vineyard Sound.
3	Addie P. Avery	652	do	296	New York	do	do	Chalk	6	Near South Truro, Mass.
3	J. G. Babcock	12903	do	276	Hoboken, N. J	do	do	Coal	7	Orleans Beach, Cape Cod.
3	Pow-wow	19560	do	63	Provincetown, Mass.	Fishing	do	Fishing-gear	5	Parmet Hollow, Cape Cod.

Jan.	4	Eunity B. Wharton	25126	....do	133	Pantego, N. C	New York	..do	Shingles and timber.	1	North Point, Hatteras Inlet, N. C.
	10	Little Kate	14756	....do	33	Boston, Mass	Fishing	..do	Fish	13	Duxbury Beach Mass.
	22	Susan A. Owens	23196	....do	30	Timber Cove, Cal	San Francisco	..do	Wood	1	Mendocino Harbor, Cal.
	31	Metropolis	90289	American steamship	878	Philadelphia	St. Thomas, Para, and Madeira River.	..do	Railroad iron, lumber, and provisions.	85	Three miles south of Currituck light, N. C.
	31	Berlinda	2793	American schooner.	13	Pensacola, Fla	Apalachicola, Fla	..do	Corn, flour, &c	4	Cape San Blas, Fla., on outside beach.
	31	Chattanooga	4049	American brig	193	Baltimore, Md	Demarara	Partial	Flour, beef, &c	3	Little Cove Point, Chesapeake Bay.
Feb.	18	Lizzie Madison	140183	American schooner	132	Eureka, Cal	San Francisco	..do	Lumber	1	Entrance to Yaquina Bay, Oreg.
	20	Fourth of July	9602	....do	15	San Francisco	Point Reyes, Cal	Total	Provisions and lumber.	3	Tennessee Cove, two miles north of Point Bonita light.
	22	Philipp Suppicich	....	German bark	328	Newcastle	Philadelphia	..do	Soda	12	Shoal, south side of Hatteras Inlet, N. C.
Mar.	24	Minnie Corlett	16632	American schooner.	107	Chicago, Ill	Two Rivers, Wis	..do	Ballast	1	Chicago Harbor.
May	5	John Clark	12549	American ship	1080	Sandy Hook	Calais, Me	..do	....do	2	Great Head, 1 mile from Cutler, Me.
	15	J. Burley	13375	American schooner.	159	Philadelphia	Washington, D. C	Partial	Coal	1	Lynn Haven Beach, Va.

Total: Vessels, 31; tons, 8,466; total losses, 26; partial losses, 5; lives lost, 275.

(3) COLLISIONS.

1877. July	14	Mary	90227	American schooner.	79	New York	Boston	Total	Coal	3	Three miles west of Eaton's Neck, Long Island, N. Y.
Aug.	2	Grace A. Channon.	85309	....do	266	Buffalo, N. Y	Chicago, Ill	..do	....do	1	Lake Michigan, 12 miles south of Milwaukee.
Sept.	16	Unknown	None.	American row-boat.	Unknown	(In New York Harbor.)	....	Unk'n.	Ballast	3	New York Harbor.
Oct.	8	Two Brothers	24018	American schooner	29	Chesapeake Bay	Baltimore	Partial	Oysters	1	One mile from mouth of Chester River, Md.
	17	Angel Dolly	1202	....do	17	San Francisco	Sacramento River	..do	Lumber	1	Three miles below Rio Vista, Sacramento River.
	27	Clinton	5177	American steamer.	194	....do	Saucelito, Cal	Total	Ballast	1	Between Arch Rock and Point Cavallo, Cal.
Nov.	14	Alex'r Young	1533	American schooner.	221	Philadelphia	Somerset, Mass	..do	Coal	2	Near Swash Channel, New York Bay.
Dec.	5	Emma J. Petty	8393	....do	31	Dredging-grounds, Chesapeake Bay.	....	Partial	Oysters	1	Oyster Creek, Md.
1878. Jan.	10	Osmyn	19215	American bark	483	Seattle, Wash	San Francisco	Total	Coal	3	Puget Sound, Wash.
	22	Baring Brothers	3043	American ship in collision with Spanish steamer Ponce.	2166	Norfolk, Va	Liverpool, England	Partial	Cotton	*3	Mouth of Mersey River, England.
	31	Nellie Bloomfield	18125	American schooner	57	New York	Greenwich, Conn	..do	Brick	2	Off City Island, N. Y.
Feb.	11	Carrie Winslow	5859	American brig	455	Montevideo	New York	Total	Wool and hides	2	New York Bay.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, &c.*—Continued.

(3) COLLISIONS—Continued.

Date of disaster.		Name of vessel.	Official number.	Description of vessel.	Tonnage.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.
1878.											
Feb.	23	James Fisk, jr	75120	American steamer	745	New York	Pavonia, N. J	Partial	Ballast	1	Off Thirteenth street, North River, N. Y.
	23	Castleton	5976	....do	604	Staten Island, N. Y	New York City	..do	....do	1	New York Bay.
Mar.	1	Virginia	25509	American schooner	65	Onancock, Va	Baltimore, Md	..do	Grain, corn &c	1	Near Seven-Foot Knoll, Chesapeake Bay.
	6	Hope	95484	American steamer	9	New Orleans	Bayou Lafourche, La	..do	Corn, oats, &c	4	New Orleans Harbor.
Apr.	7	Perry	20043	American bark	150	Edgartown, Mass	Whaling voyage	..do	Outfits	1	Latitude 12° north, longitude 40° west. (In January man fell from aloft and died of his injuries.)
	23	Racer	21237	American schooner	54	Gloucester, Mass	New York	..do	Fish	1	Off the New Jersey coast.
June	1	Sarah C. Pyle	23818	....do	53	....do	Fishing	..do	Fish, bait, and ice	2	Twenty miles southeast by south from Cape Ann.
	1	Dr. J. P. Whitbeck	6840	American steamer	11	Brooklyn	New York	..do	Ballast	2	East River, N. Y.
	26	Peshtigo	19663	American schooner	385	Buffalo, N. Y	Chicago, Ill	Total	Coal	2	Ten miles east of Beaver Island light, Lake Michigan.

* From the Spanish vessel.

Total: Vessels, 21; tons, 6,074; total losses, 7; partial losses, 14; lives lost, 38.

(4) CASUALTIES FROM OTHER CAUSES.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tons.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.	Nature of casualty.
1877. July 8	Banner	2155	Am. sch	289	Bay City, Mich	Chicago, Ill	No damage.	Lumber	1	Four miles E. S. E. of Sturgeon Point, Lake Huron.	Fell overboard.
12	Tatay	24580	Am. bark	582	Portland, Me	Cape Town	do	do	1	At sea	Washed off jib-boom.
15	Cuba	73338	Br. bark	263	Montego Bay, Jamaica.	London, England	Partial	General merchandise.	1	Off Charleston, S. C	Fire.
21	Unknown	None	Am. row-bt	Unk'n.	Highland, N. Y	Poughkeepsie, N. Y.	No damage.	Ballast	2	Hudson River, N. Y., off Poughkeepsie.	Upset by steamer.
28	Plowboy	150097	Am. sch	39	Walnut Grove, Cal.	San Francisco, Cal.	do	Barley	1	Three miles below Walnut Grove, Cal.	Knocked overboard by boom.
30	Muskegon	90466	Am. str	618	Grand Haven, Mich	Chicago, Ill	do	Sundries	1	Forty miles from Grand Haven, Mich.	Fell overboard.
Aug. 2	M. B. Spaulding	16327	Am. barge.	369	Bay City, Mich	Holland, Mich	do	Lumber	1	On passage	Do.
9	J. G. Wall	75823	Am. sch	98	Crescent City, Cal	San Francisco, Cal.	do	do	1	Nine miles off Point Arenas light, Cal., E. by N.	Knocked overboard by fore-boom.
10	Sarah	23918	Am. bark	558	Boston, Mass	Valparaiso	Partial	General	1	At sea	Lost spars and sprung a leak; succession of gales.
12	Chief Justice Waite	125281	Am. str	571	Put-in Bay, Lake Erie.	Toledo, Ohio	No damage.	Ballast	1	Maumee River, near Iron Dock.	Fell overboard.
13	Champlain	5848	do	438	Chicago, Ill	Ogdensburg, N. Y	do	do	1	Five miles north of Chicago.	Do.
14	N. L. Drew	18591	Am. sch	121	San Francisco, Cal.	Newport, Oreg	do	do	1	Ten miles west of Newport.	Do.
18	Matt White	16995	Am. str	28	Richmond, Va	Hampton Roads	Total	do	3	Wharf at Rip Raps, Hampton Roads.	Explosion of boiler.
22	Reform	21646	do	182	San Francisco, Cal	Sacramento River.	No damage.	Lumber	1	Collinsville, Suisun Bay, California.	Fell overboard, supposed in a fit.
25	T. W. Snook	24949	do	169	Cleveland, Ohio	Detroit, Mich	do	Ballast	1	Malden, Ontario, Detroit River.	Thrown overboard by the sheet.
25	Champion	4277	Am. sch	586	Buffalo, N. Y	Chicago, Ill	do	Coal	1	Lake Erie	Fell from mainmast-head.
26	Pet	150121	Am. steam-yacht.	10	In Chicago Harbor.		do	Ballast	1	Chicago Harbor	Stepped overboard.
30	Brooklyn	2112	Am. sch	376*	Unknown	Unknown	do	do	1	Welland Canal	Fell overboard.
30	Cora	5136	do	155	Casper Creek, Cal.	San Francisco, Cal.	do	Lumber	1	Near Point Lobos, Cal.	Knocked overboard by fore-boom.
Aug. —	Ida F. Taylor	12479	Am. bark	621	Newcastle, N. S. W.	Hong-Kong, China	Total	Coal	14	At sea	Missing.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, &c.*—Continued.

(4) CASUALTIES FROM OTHER CAUSES—Continued.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tons.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.	Nature of casualty.
1877. Sept. 4	Florence	9773	Am. sch	61	Patuxent River, Md.	Baltimore	No damage.	Wood	1	Three miles N. of Sharp's Island, Chesapeake Bay.	Line attached to tiller parted and threw him overboard.
10	Unknown	None	Am. row-boat.	Unk'n.	Unknown	Unknown	..do	Ballast	3	New York Harbor	Upset by steamer.
11	Pony	19755	Am. str	12	Muskegon, Mich	Port Sherman, Mich	..do	...do	1	Muskegon Lake	Fell overboard.
16	Unknown	None	Am. row-boat.	Unk'n.	In New York Harbor.		..do	...do	2	New York Harbor	Upset by steamer.
18	John McCullough	75521	Am. sch	72	San Francisco	Shoal Water Bay, W. T.	..do	...do	1	Latitude 40° 51′ N., longitude 130° 45′ W.	Jumped overboard in a state of delirium.
20	Sea Nymph	23196	...do	91	...do	Cuffey's Cove, Cal.	Partial	Merchandise	1	Eight miles W. of Point Reyes, Cal.	Carried away head-gear in strong N. W. wind.
25	Monguagon	90658	...do	301	Oswego, N. Y	Chicago, Ill	No damage.	Ballast	1	Lake Ontario, three miles from Port Dalhousie, Ontario.	Knocked overboard by an anchor while securing same.
26	Hattie Earl	11175	...do	101	Muskegon, Mich	...do	..do	Lumber	1	Muskegon Lake, one mile W. of Muskegon.	Fell from truck to deck.
27	Commonwealth	5247	...do	48	Rockland, Me	Boston, Mass	Partial	Lime	1	Off Damascove Island, Maine.	Fire.
30	William Fisher	26762	...do	64	Pensacola, Fla	Savana la Mar, W. I	..do	Lumber	1	Longitude 89°, latitude 26°.	Dismasted in a hurricane.
Sept. —	William H. Besse	80366	Am. bark	1,027	Port Townsend, W. T.	Bath, Me	..do	Timber	1	Off Cape Horn	Damaged mast, rigging, sails, &c., in a heavy gale.
Oct. 3	Maize	16615	Am. sch	269	Buffalo, N. Y	Toledo, O	No damage.	Salt	1	Off Fairport, Ohio	Pulled overboard by jib-sheet.
5	Eliza White	8056	Am. bark	412	Turk's Island, W. I.	Boston, Mass	..do	...do	1	Off Cape Cod	Washed overboard.
5	Minerva	17878	Am. sch	31	Baltimore, Md	Annapolis, Md	..do	Ballast	1	One mile from Sandy Point, Chesapeake Bay.	Fell overboard.
6	Charger	5490	...do	278	Port Colborne, Ontario.	Toledo, O	..do	Salt	1	Off Grand River, Lake Erie.	Do.
6	Dictator	6921	...do	63	Gloucester, Mass	George's Banks	..do	Ballast	1	On Middle Bank, 30 miles E. S. E. from Cape Ann.	Thrown overboard by sail.

9	Lena Hunter	15375	do	285	Salem, Mass	Baltimore, Md	do	Ice	1	Off Sinnepuxent, coast of Virginia.	Fell overboard from mast-head.
10	Jesse J. Parks	13917	do	30	Baltimore, Md	Dredging-grounds, Chesapeake Bay.	do	Ballast	1	Off Willow Springs, Patapsco River.	Fell overboard.
10	Contest	4348	do	209	Muskegon, Mich	Chicago, Ill	Partial	Lumber	1	Thirty miles S. W. of Muskegon.	Shipped a sea and lost part of deck-load.
16	Tennessee	24702	do	24	Pokomoke Sound, Va.	Norfolk, Va	Total	Oysters	5	Off Windmill Point, Chesapeake Bay.	Capsized.
16	Golden Fleece	10197	do	452	Chicago, Ill	Buffalo, N. Y	No damage.	Ballast	1	Buffalo, N. Y	Fell overboard.
25	John R. Noyes	75434	do	334	Port Hope, Ontario	Toronto, Ont	do	Barley	1	Ten miles S. E. of Toronto, Lake Ontario.	Fell overboard.
28	Sam. Cook	115186	do	319	Milwaukee, Wis	Oswego, N. Y	do	Wheat	1	Abreast of Tawas Harbor, Lake Huron.	Breaking of tow-line.
Nov. 2	B. S. Williams, jr	Unk.	do	628	Boston	Baltimore	do	Ballast	1	Off Point Lookout, Chesapeake Bay.	Fell overboard from flying-jib boom.
3	Patron	19962	do	34	New Haven, Conn	Lyme, Connecticut.	Partial	do	1	Off Clinton Point, Long Island Sound.	Breaking of main boom.
8	Fairy	120302	do	23	Rockport, Tex	Calcasieu, La	Total	do	2	Ten miles N.E. of Pass Cavallo Bar.	Capsized.
10	Charles A. Coulomb.	125115	do	443	Lisbon	Philadelphia	No damage.	do	1	Latitude 37° 30′ N., longitude 67° 45′ W.	Fell overboard.
18	Grace Choate	10292	do	42	Gloucester, Mass	Fishing-cruise	do	do	4	Twenty-five miles S. E. by E. from Thatcher's Island.	Drowned while attending their trawls.
21	Wm. J. Carroll	26975	do	37	Dredging-grounds, Chesapeake Bay.		do	Oysters	1	Off James Point, Chesapeake Bay.	Knocked overboard by windlass.
22	Otis R. Johnson	18962	do	128	White Lake, Mich	Chicago, Ill	do	Shingles	1	Five miles S. E. of Milwaukee, Wis.	Knocked overboard by mainsail.
23	City of Chester	125473	Am. steamship.	1,106	Portland, Oreg	San Francisco	Partial	Produce and merchandise.	*1	Mouth of Columbia River.	Damaged hull, &c.
Nov. 25	B. & J. Baker	2304	Am. str	213	Norfolk, Va	Nag's Head, N. C	No damage.	Ballast	5	Near Currituck Beach, N. C.	Drowned by the capsizing of boat in attempting to go to aid survivors of the wrecked steamer Huron.
27	C. H. Northam	125117	Am. str	1,437	New Haven, Conn	New York, N. Y	do	Ballast	3	New York City	Fire.
28	Caroline Virginia	4009	Am. sch	51	Baltimore	Potomac River	No damage.	do	1	Drum Point, Chesapeake Bay.	Upsetting of yawl-boat.
Nov. —	Kendrick Fish	14236	Am. ship	1,327	Baltimore, Md	Bremen	do	Petroleum	2	At sea	Washed overboard.
	Wau-bun	80380	Am. brig	508	Seville, Spain	New York	do	General	1	Latitude 24°, longitude 40°.	Fell overboad.
	Chas. Shearer	4467	Am. sch	97	Azore Islands	On a whaling voyage.	Total	Outfits, stores, &c.	13	At sea	Abandoned.
Dec. 1	Lotus	140263	Am. str	271	Shreveport, La	New Orleans	do	Cotton and cotton-seed.	15	Waterloo, Mississippi River, five miles below Bayou Sara, La.	Fire.
1	Mary E. Rankin	17822	Am. sch	349	Philadelphia	Trieste, Austria	do	Kerosene	1	Harbor of St. George, Bermuda.	Fire. (Man knocked overboard in squall on passage.)
2	Charles J. Kershaw.	125251	Am. str	1,324	Cleveland, Ohio	Chicago, Ill	No damage.	Coal	1	Saginaw Bay, Lake Huron.	Fell overboard.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, &c.*—Continued.

(4) CASUALTIES FROM OTHER CAUSES—Continued.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tons.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.	Nature of casualty.
1877. Dec. 2	Maggie Cain	90125	Am. sch	434	Somerset, Mass	Philadelphia	do	Ballast	1	Off Sandy Hook, N. J.	Fell overboard from main rigging.
8	Hesperian	11667	Am. brig	241	Seattle, W. T	San Francisco	do	Lumber	1	At sea	Fell overboard from top-gallant yard.
14	Elwood Burton	8814	Am. sch	395	Portland, Me	Matanzas, W. I	Partial	Shooks	1	Latitude 40° N., longitude 69 W.	Damaged rigging in a heavy gale.
17	Twilight	145013	do	185	San Pedro, Cal	Coos Bay, Oregon	No damage.	Ballast	1	Marshfield, Coos Bay, Oregon.	Fell overboard from yawl.
22	J. V. Wellington	12659	do	257	Boston, Mass	New York	do	do	1	Nausett, Cape Cod, bearing S. W., distant four miles.	Fell from mast-head.
30	Ironsides	12297	Am. bark	507	Palermo, Sicily	New York	do	do	1	At sea	Fell overboard from jib-boom.
30	E. A. Sanchez	135050	Am. sch	493	Cabarien, Cuba	New York	do	Sugar	1	Latitude 27° 10′, longitude 75° 55′.	Knocked overboard by foresail.
Dec. —	B. F. Metcalf	2990	Am. ship	1,050	Samarang, Java	Falmouth, Eng	Total	do	21	At sea	Missing.
1878. Jan. 1	Mary Freeland	90434	Am. sch	398	Boston	Philadelphia	No damage.	Logwood	1	Boston Harbor	Killed by main-boom.
2	M. W. Drew	90212	do	165	Port Johnson, N. J.	Portland, Me	Partial	Coal	1	Three miles east of Cape Cod light.	Damaged sails, &c., in a snow-squall.
3	Wm. O. Irish	26680	do	182	Newport, R. I	Boston, Mass	Total	do	5	On passage	Missing.
3	Elizabeth	8977	do	54	Rappahannock River, Va.	Baltimore	No damage.	Lumber	1	Mouth of Patuxent River, Chesapeake Bay.	Knocked overboard by fore boom.
4	Trenton	24187	do	129	Vineyard Haven	Boston	Partial	Coal	1	At sea	Lost sails, spars, &c.
4	Wyoming	80326	do	197	Salem, Mass	Wilmington, N. C.	No damage.	Ice	1	Off Cape Hatteras	Washed overboard in a heavy gale.
8	John F. Kranz	75313	do	547	Rotterdam	Baltimore	Partial	Ballast	1	Latitude 35° N., longitude 60° 31′ W.	Damaged sails, &c., in a gale.
25	Western Shore	80493	Am. ship	1,178	San Francisco	Seattle, W. T	No damage.	do	1	Three miles from Point Lobos, Cal.	Killed by hawser slipping.
28	Wm. E. Cheney	80282	Am. str	71	(In harbor New York City.)		Partial	do	1	North River, New York City.	Explosion of boiler.
30	Lillie B	140151	Am. sch	18	(At wharf Baltimore, Md.)		No damage.	do	1	Baltimore, Md	Fell overboard.
31	Caprice	5913	do	70	New York		Partial	do	1	Longitude 75°, latitude 40°.	Lost mast, sails, &c., in a heavy gale.

31	Sallie M. Steelman	115092	....do	394	Charleston	Baltimore	Total ...	Phosphate rock	1	One hundred and forty-six miles E. by N. from the Bermudas.	Abandoned.
Jan. –	Carrie P. Morton ..	125095	....do	84	Gloucester, Mass ..	Grand Banks	..do	Salt stores and fishing-tackle.	14	At sea	Missing.
	John W. Hunt ...	75152	Am. brig ..	436	Boston, Mass	Kingston, Jamaica	..do	Ice	10	....do	Do.
	Lady Woodbury ..	15248	Am. sch ..	75	Gloucester, Mass ..	Jamaica	..do	General	6	....do	Do.
Feb. 1	Charles C. Overton	125606	Am. bg'ne.	185	New York	Nassau	..do	Coal	7	....do	Washed ashore, capsized.
3	Lessie Taylor	15710	Am. str ...	435	Washington, La ..	New Orleans	..do	Cotton, sugar, &c.	6	Atchafalaya, La	Snagged and sunk.
4	Angie McNamara	1862	Am. sch ..	47	Dredging-grounds, Chesapeake Bay.	....	No damage.	Ballast	1	Barren Island, Chesapeake Bay, off Patuxent River.	Killed by crank-handle of a machine.
9	Katie Flickinger ..	14347	Am. bkne .	472	Port Blake, Wash	San Francisco	Partial ..	Coal and lumber.	2	At sea	Damaged rudder, &c., in a heavy storm.
17	General Miller	85358	Am. sch ..	109	San Francisco	Oonalaska, Alaska Territory.	..do	General merchandise.	10	Thirty miles N. W. from Point Reyes, Cal.	Capsized.
22	Cassandra Adams	125559	Am. bark	1,127	Nanaimo, B. C	San Francisco	No damage.	Coal	1	Latitude 44° 20′ N., longitude 128° 16′ W.	Washed overboard.
27	Bertha	2502	Am. ship ..	955	Liverpool, England	Portland, Me	Partial ..	Salt	3	Longitude 33°, latitude 54°.	Damaged rigging in a heavy sea.
Feb. —	Voyager	25900	....do	1,336	New York	Bristol, England ..	Total ...	Grain, flour, &c	24	At sea	Missing.
Mar. 5	Western Leader ..	26969	Am. sch ..	22	Dredging-grounds, Chesapeake Bay.	....	No damage.	Oysters	1	Two and one-half miles below Plum Point, Chesapeake Bay.	Knocked overboard by main-sheet.
7	City of Chester ...	5871	Am. str ...	789	Saint Louis, Mo ...	Memphis, Tenn ...	Total ...	General merchandise.	3	Memphis, Tenn	Fire.
11	Ellen Tobin	8994	Am. sch ..	435	Baltimore, Md	Jersey City, N. J ..	Partial ..	Coal	1	Eight miles E. by N. of Barnegat, N. J.	Damaged sails in a heavy storm.
12	Polar Wave	150018	....do . ..	91	Gloucester, Mass ..	Fishing	No damage.	Fish	1	Latitude 43° 30′, longitude 55°.	Washed overboard.
15	Long Wood	15721	....do	66	Boston, Mass	Norfolk, Va	..do	Ballast	1	Off Capes of Virginia	Struck by lightning.
20	Dictator	6721	....do	63	Gloucester, Mass ..	George's Bank	..do	....do	1	Fifteen miles from George's Bank.	Thrown overboard by mainsail.
23	Unknown	Unk.	Am. sloop	Unk'n.	Unknown	Unknown	Total ..	....do	1	Three miles W. of Grand Point au Sable, Mich.	Capsized.
26	Sarah Louisa	22040	Am. sch ..	48	Rappahannock River, Va.	Baltimore, Md	No damage.	Lumber	1	Off Point No Point, Chesapeake Bay.	Knocked overboard by foreboom.
Mar. —	Johanna M. Brock.	75842	....do	134	San Francisco	Humboldt Bay, Cal	Total ...	Ballast	6	Coast of Oregon	Capsized.
Apr. 5	Col. A. P. Kouns ..	125348	Am. str ...	310	New Orleans, La ..	Jefferson	..do	General	2	Negro Point, 70 miles above mouth of Red River, La.	Snagged and sunk.
5	Geo. Churchman ..	85371	Am. sch ..	281	Fernandina, Fla ...	New York	No damage.	Lumber	1	Off Cape Romain, S. C	Lost overboard in a gale.
9	Dictator	6208	Am. barge.	300	Buffalo, N. Y	Chicago, Ill	..do	Coal	1	Five miles E. of Thunder Bay light, Lake Huron.	Washed overboard.
9	Tom O'Shanter ...	145080	Am. bkne	592	Columbia River ...	San Francisco	..do	Lumber	1	Latitude 38° 50′ N., longitude 124° 10′ W.	Fell overboard in a gale.
11	Newport	130056	Am. str ...	165	Wilmington, Cal ..	Newport, Oreg ..	..do	Grain	4	Newport Bar	Capsizing of boat.

TABLE 63.—*Wrecks and casualties on and near the coasts and on the rivers of the United States, &c.*—Continued.

(4) CASUALTIES FROM OTHER CAUSES—Continued.

Date of disaster.	Name of vessel.	Official number.	Description of vessel.	Tons.	Port sailed from.	Port bound to.	Whether resulting in total or partial loss.	Nature of cargo.	Number of lives lost.	Place of disaster.	Nature of casualty.
1878. Apr. 13	Macauly	16080	Am. ship	1,092	Rotterdam, Hol	Baltimore	No damage.	Ballast	1	Latitude 49° 25′ N., longitude 5° 20′ W.	Fell overboard in a gale.
Apr. 20	Ukraine	25071	Am. bark	730	Matanzas, Cuba	New York	do	Sugar	1	Off Sandy Hook, N. J	Killed by parting of hawser.
25	Pelican	20415	Am. sch	814	Chicago, Ill	Buffalo, N. Y	do	Corn	1	Off Mackinaw, Mich	Fell overboard.
28	Concordia	5792	do	98	Kodiak, Alaska	Port Etches, Alaska.	do	Merchandise	1	Latitude 59° 10′ N., longitude 150° 7′ W.	Do.
Apr. —	George P. Haub	85457	do	123	San Francisco	Humboldt, Cal	Total	Unknown	8	Unknown	Missing.
	Cordelia	125180	Am. str	60	do	Coquilla River, Oreg.	do	General merchandise.	5	At sea	Capsized.
May 1	Warner	26809	do	395	New Orleans, La	Saint Louis, Mo	do	Ballast	4	Memphis, Tenn	Explosion of boiler.
7	Guiding Star	85006	Am. sch	324	Oswego, N. Y	Charlotte, N. Y	No damage.	do	1	Two and one-half miles N. E. of Charlotte, N. Y.	Fell overboard from mast-head in a fit.
14	Belle Mitchell	2802	do	320	do	Chicago, Ill	do	do	1	Five miles N. W. from piers at Oswego, N. W.	Fell overboard while securing yawl.
15	Frithiof	120152	do	243	Port Gamble, W. T	San Francisco	do	Lumber	1	At sea	Knocked overboard by jib.
22	Christiana	125353	do	20	Port Washington, Wis.	Chicago, Ill	do	Stone	1	Ten miles E. S. E. of Kenosha, Wis.	Knocked overboard by sail.
25	Nassau	18734	do	315	Fairhaven, N. Y	do	do	Coal	1	Detroit River, ¾ of a mile from Walkerville, Canada.	Fell overboard while working on outside of vessel.
June 2	Ariel	105582	do	143	Choumagin Islands	San Francisco	do	Fish	1	Latitude 55° 15′ N., longitude 157° 34′ W.	Washed overboard.
4	A. C. Bissell	None	Am. st'm launch.	Unk'n.	Port Ontario, N. Y	Oswego, N. Y	Partial	Ballast	1	Six miles E. of Oswego light-house.	Blowing out of one of the flues.
17	Champion	5723	Am. sch	42	San Francisco, Cal.	Salt Point, Cal	No damage.	do	1	Salt Point, Cal	Capsizing of small boat.
20	Exile	8183	do	387	Cleveland, Ohio	L'Anse, Mich	Partial	Coal	1	Off Huron Islands, Lake Superior.	Damaged sails, rigging, &c., in a high wind.
25	Swallow	23494	do	275	Milwaukee, Wis	Toledo, Ohio	No damage.	Ballast	1	Escanaba, Mich	Fell down the hatch.

Total: Vessels, 122; tons, 39,497; total losses, 23; partial losses, 22; no damage, 77; lives lost, 304.

TABLE 64.—*Wrecks and casualties on or near the coasts and on the rivers of the United States, &c., during the year ending June 30, 1878, involving* LOSS OF LIFE.

Nature of casualties.	Number of vessels.	Tonnage.	Total loss.	Partial loss.	No damage to vessel.	Number of lives lost.
Founderings	15	4,403	15			73
Strandings	31	8,466	26	5		275
Vessels collided	21	6,074	7	14		38
Other causes	122	39,497	23	22	77	304
Total	189	58,440	71	41	77	690

NOTE.—In this table are included 92 lives lost in cases where no damage was sustained by the vessel or cargo meeting with such casualty; for example, seamen lost overboard in gales; falling from masts and yards; knocked overboard by jib; drowned by upsetting of small boats, &c. Shown in division (4)—Casualties from other causes—Table 63.

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded during the last ten years.*

ATLANTIC COAST.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Absecom, N. J		1		1			3	2			7
Addison, Me	2							1			3
Ajax Reef, Fla						1					1
Alden Rock, Portland, Me								1		1	2
Allen Island, Penobscot Bay							1				1
Amazeen Island, N. H							1				1
American Shoal Reef, Fla						1				2	3
Annisquam Light, Mass. (¼ mile east from)										1	1
Aransas, Tex		2	1	1		1		1	1		7
Asbury Beach, N. J										1	1
Ash Island, Me. (Muscle Ridge Channel)										1	1
Assateague Beach, Va. (off)										2	2
Assawaman Inlet, Va						1					1
Asylum Bridge, R. I		2									2
Atlantic City, N. J	1								1		2
Avery's Rock, Mass						1			1		2
Back Beach, Me							1				1
Back River (mouth of), Chesapeake Bay										1	1
Bailey Island, Me							1			1	2
Baker Island Bar, Mount Desert, Me								2			2
Bang's Island, Me					1			1			2
Bantum Ledge, Me									1		1
Barnegat, N. J	1	2	2	2		3	2	1	1	1	15
Barnegat Inlet, N. J								2	1		3
Barnegat Inlet (7 miles south of)									1		1
Barnegat Light (4 miles south of)									1		1
Bar Harbor, Mount Desert, Me									1		1
Bar Ledge, Petit Manan, Me									1		1
Bar Neck Sands, Talbot County, Md									1		1
Barred Harbor, Cape Cod									1		1
Barrett's Point, N. Y								1			1
Barter Island, Southeast Bay, Me							1				1
Bartlett Reef, Conn						1				2	3
Bass Island, Cape Porpoise, Me								2			2
Bass River Breakwater, Cape Cod				1					1		2
Bakeman Point, R. I				1							1
Bating Hollow Beach, L. I									1		1
Battery Point, Black Rock, Conn									1		1
Bayou Reef, South Pass, La							1				1
Bay Shore, N. J					1						1
Bay View, Cape Ann, Mass							1				1
Beach Island, Me						1					1
Beach Point, Truro, Mass									1		1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Beacon Ledge, Portsmouth										2	2
Bear Point, near Addison, Me								1			1
Bearse's Shoal, Cape Cod						1					1
Beaufort, N. C									1		1
Beaufort Bar, N. C	2			1			2				5
Beaufort Reef, N. C								1			1
Beaufort, S. C						1				1	2
Beaver Tail Rock, R. I		1	2	1		1	1	1	1		8
Beermore Ledge, Cape Ann									1		1
Biddeford Pool, Me						1					1
Birch Point, Wiskeag River, Me								1			1
Bishop and Clerk's Shoals, Mass							1		2		3
Black Head, Me. (off)										1	1
Black Island, Me							1				1
Black Ledge, New London, Conn								1	1		2
Black Rock, Block Island, R. I					1					1	2
Black Rock, Conn								2	1		3
Blackwell's Island, N. Y						1				1	2
Block Island, R. I	2						4	3	1	3	13
Block Island, R. I. (southeast point of)										1	1
Block Island, R. I. (southwest shore of)									2		2
Bloody Point, Kent Island, Md									1		1
Blue Hill Bay, Me				1							1
Blue Rock, R. I		1									1
Bluff Island, Saco Bay, Me								1			1
Bodkin Bar, Chesapeake Bay						1					1
Bodkin Point (southeast bar), Chesapeake Bay									1		1
Body Island Light, N. C						1					1
Bogue Inlet, Swansborough, N. C									1		1
Bogue Island									1		1
Boisbubert Island, Me							1				1
Bolivar Beach, Tex								1			1
Bolivar Point, Tex			1								1
Bombay Hook, Delaware Bay									1	1	2
Bonds, N. J. (½ mile north of L. S. S. 22, district 4)								1			1
Boon Island, Me					1	1					2
Booth Bay, Me		1				1	1			1	4
Boston Neck, R. I						1					1
Bower's Beach, Delaware Bay										1	1
Brace Cove Point, Cape Ann										1	1
Brandywine Shoals, Delaware Bay						2	3	1	1		7
Branford Reef, Long Island Sound									1	1	2
Brant Island Shoal, Pamlico Sound								1			1
Brazos Bar, Tex				1				1		1	3
Brazos de Santiago, Tex							4				4
Breaking Ledge, Me							1				1
Brenton Reef, R. I	3				1	1			1		6
Brewster's Beach, Mass			1								1
Brewster's Reef, Fla						1					1
Bridgehampton Beach, Long Island									1		1
Bridgeport, Conn									1		1
Brigadier Island, Penobscot Bay, Me										1	1
Brigantine Bar, N. J								2			2
Brigantine Shoals, N. J	2	3	2		2	6	1		1	1	18
Brimstone Point, N. J									1		1
Browney Island (entrance to Englishman's Bay), Me								1			1
Brown Ledges, Penobscot Bay							1				1
Buckarce Shoals, Va						1					1
Buckle's Island Harbor, Me								1			1
Bullock's Point, R. I		1									1
Bull Rock, Boston Bay						1					1
Bull Rock, Carver Harbor, Me										1	1
Bunker's Ledge, Me						1					1
Buzzard's Bay (Middle Ledge), Mass										1	1
Calf Island, Boston Harbor									2		2
Campobello Beach, Eastport, Me								1			1
Caney Creek, Tex							1				1
Cape Ann, Mass			1						1	1	3
Cape Arundel, Me							1				1
Cape Canaveral, Fla				1							1
Cape Charles, Va						1					1
Cape Cod (back of)									1		1
Cape Cod, Mass. (precise locality not stated)	1	1	1		1						4
Cape Cod Light (5 miles south of)										1	1
Cape Elizabeth, Me						1	1	2	1		5

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fisial year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Cape Fear, N. C						1					1
Cape Fear River, N. C. (mouth of)							2	1	1	1	5
Cape Florida Light-house									1		1
Cape Hatteras, N. C	1		1	2	2		1	2			9
Cape Hatteras, N. C. (20 miles north of)									1		1
Cape Hatteras, N. C. (30 miles south-southwest of)								1			1
Cape Henlopen, Del						5	1	5	5		16
Cape Henlopen, Del. (7 miles south of)										1	1
Cape Henry, Va	1						3		6	2	12
Cape Henry, Va. (4 miles south of L. S. S. No. 1)								1			1
Cape Lookout, N. C	1	3		1	1	1	2	1			10
Cape May, N. J					3	1	2		1		7
Cape May, Hereford Light, N. J								1			1
Cape May Steamboat-Landing, N. J								1			1
Cape Poge, Mass						2		1	1		4
Cape Porpoise, Me				1			1				2
Cape Romain, S. C								1			1
Cape San Blas, Fla								1		1	2
Cape Small Point, Me						1					1
Captain's Island, Long Island Sound	1									1	2
Caroline Shoal, N. C						1					1
Carson's Inlet, N. J	1				1						2
Carter's Bar, Va	2	1						1			4
Carysfort Reef, Fla							1				1
Cash's Reef, East River, N. Y								1			1
Castle Hill, R. I									1		1
Cedar Island, Va						1		1			2
Cedar Keys, Fla			1		1					1	3
Cedar Tree Neck, Vineyard Sound							1				1
Chandeleur Island Light, La							1				1
Chandeleur Island Light, La. (4 miles southeast of)								1			1
Chandeleur Island Light, La. (14 miles southwest of)									1		1
Charles Island, Conn							1				1
Charleston Bar, S. C						1	1				2
Charleston Harbor, S. C								2			2
Charlotte Harbor, Fla										1	1
Chatham Bar, Cape Cod	2		2	1	6	2		5		2	20
Chatham, Mass							1			1	2
Chebeag Island, Me								1	1		2
Cherrystone Inlet, Va									1		1
Cherrystone Light, Va. (5 miles above)								1			1
Chester River, Md. (mouth of), Chesapeake Bay									1		1
Chicamacomico, N. C	1										1
Chincoteague, Va		1	1			1					3
Chincoteague, Va. (15 miles north)									1		1
Chincoteague Shoals, Va								1	1		2
Cincinnati Bar, N. J							1				1
City Island, Long Island									1	1	2
Clapboard Island, Me								1			1
Clark Island, Me							1				1
Clark Island, Portsmouth, N. H								1		1	2
Clear Water, Fla					1						1
Clement's Cove, Me						1					1
Cliff Shore, Mass						1					1
Clinton Point, Long Island Sound				1							1
Coaster's Harbor Island, R. I		2									2
Cobb's Island, Va			1						1	1	3
Cobscook Bay, Me									1		1
Cold Spring Inlet, N. J				1	1	2	2	1	6	2	15
Common Flats, Cape Cod, Mass						1					1
Conanicut, R. I		2			2		1				5
Conch Reef, Fla									2		2
Coney Island, N. Y					1				1		2
Copps Island							1				1
Coral Reef, Fla					1						1
Core Sound, N. C							1				1
Cove Point, Chesapeake Bay (near)								1	1		2
Cow's Shoal, Stamford, Conn. (off)										1	1
Cox Head, Me								1			1
Cox's Shoal, N. J					1						1
Crab Meadow, Long Island Sound					1						1
Crabtree Point, North Haven, Me									1		1
Cranberry Island, Me								2	1	2	5
Cranberry Island Light, Petty Pan Reef, Me								1			1
Crane's Neck Point, Long Island										1	1

TABLE 35.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Crooker's Reef, Fla						1					1
Cross Island, Me			2			2					4
Cuckolds, Me						2					2
Cumberland Island, Ga						1					1
Currituck Inlet, N. C		1	1		2	2	1				7
Currituck Light, N. C. (3 miles south of)										1	1
Curtis Island, off Stony Creek, Conn								1			1
Cushing's Island, Portland Harbor									1		1
Cutler, Me	4	1	2			1				1	9
Cuttyhunk Island, Mass	1			2			2	3	3	2	13
Cuttyhunk Light (½ mile southwest of)									1		1
Damiscove Island, Me									1		1
Davis Neck, Mass							2				2
Davis Shoal, Florida Reef							2				2
Davis Straits, Herring Gut, Me									1		1
Dawson Shoal (near Watchapreague Inlet, Va.)						1		1	1	3	6
Deal Beach, N. J								2	1	2	5
Dearmon Ledge, near Gloucester									1		1
Decros Point, Tex								1			1
Deer Island, Me	1						1				2
Deer Island Point (2 miles north of Eastport)										1	1
Deer Island Shore Ledge, Me								1			1
Delaware Breakwater, Del	1		2	1		1	2	2	1	2	12
Dennis, Cape Cod, Mass								1			1
Dennisport Bar, Mass										1	1
Despair Island, Narragansett Bay									1		1
Devil's Back, Boston Harbor									1		1
Diamond Reef, Cape Hatteras (off)										1	1
Dicken's Point, Block Island, R. I			1								1
Dighton, Mass			1								1
Dix Flat, Mass							1				1
Doboy Sound (south breakers), Ga								1			1
Dogfish Ledges (entrance to Cross Island Narrows), Me										1	1
Dog Island, Saint Croix River (mouth of), Passamaquoddy Bay										1	1
Dread Ledge, Mass						1					1
Drinkwater Point, Me										1	1
Duck Island, Mass							1			1	2
Duck Key, Fla									1		1
Duck Ledge, Me							1				1
Dumpling Rock, Buzzard's Bay, Mass								1			1
Dutch Island, R. I						1		2	1	1	5
Duxbury Beach, Mass										1	1
East Bank, Sandy Hook (off)										1	1
East Chop, Vineyard Haven							2		1		3
East Rockaway Bar, Long Island									1		1
Eaton's Neck, Long Island, N. Y						1					1
Edgartown (outer flats), Mass										1	1
Edgartown Harbor (near light-house)										1	1
Elbow Reef, Fla						1					1
Eldridge's Shoal, Vineyard Sound								1			1
Elihu's Island, Pawcatuck Bay, R. I								1			1
Elizabethport Bar, N. J								1			1
Emery's Point, Me						1					1
Falkner's Island, Long Island Sound								1			1
Fall River, Mass								3			3
Falmouth, Mass. (near)										1	1
False Cape, Va							2			1	3
Fargo River, Long Island, N. Y					1						1
Far Rockaway, Long Island									1		1
Fawn Bar, Boston Bay						1			1		2
Fenwick's Island, Md									1	2	3
Fenwick's Island, Md. (3 miles south of)										1	1
Fenwick's Island, Md. (10 miles south of)								1			1
Fernandina Bar, Fla							1				1
Fire Island, Long Island, N. Y					2	1	2				5
Fire Island, near Northport, Penobscot Bay								1			1
Fire Island Bar, Long Island, N. Y								2			2
Fire Island Inlet, Long Island, N. Y								1			1
Fire Island Light, Long Island, N. Y. (5 miles east of)								1			1
Fire Island Light, Long Island, N. Y. (8 miles east of)								1		1	2
Fire Island Light, Long Island, N. Y. (15 miles east of)										1	1
Fisher's Island, Long Island Sound		2				3	1	1		1	8
Fisherman's Inlet, Chesapeake Bay									1		1
Fisherman's Island, Me						1		1			2

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Fishing Island, N. H							1				1
Five Mile Beach, Cape May									1		1
Flander's Bay, Long Island							1				1
Fletcher's Neck, Me							1				1
Flogger's Shoal, Delaware Bay							1	1			2
Flood Rock, Hell Gate, N. Y									1	1	2
Florida Reef, Fla			2			1			1	1	5
Flye Island Light-house, Me. (1½ miles northwest of)								1			1
Folly Island, Cape Porpoise, Me								1			1
Fort Green, R. I								1			1
Fort Independence, Boston Harbor										1	1
Fort Island, Me						1					1
Fort Macon, N. C							1		1		2
Fort Point Rock, Gloucester Harbor									1		1
Fort Pond Bay, Long Island, N. Y						1					1
Fort Preble, Cape Elizabeth, Me								1			1
Fort Taylor, Fla							1				1
Fowey Rocks, Fla										1	1
Fox Island, Me. (northern head of)								1			1
Franklin Light, Me							1				1
French Reef, Fla					1		1				2
Freshwater Cove, Mass						1					1
Frisbee Ledge, Me						1					1
Frying Pan Shoals, N. C			1							2	3
Gallop's Island, Boston Harbor							1				1
Galveston, Tex			3	2		2		1		2	10
Galveston, Tex. (7 miles west of)									1		1
Galveston Bar, Tex									1		1
Galveston Island, Tex. (east end of)								3			3
Gangway Rock, off Watch Hill, R. I								1			1
Gardiner's Bay, N. Y							1				1
Gardiner's Island, Long Island Sound									1		1
Gardiner's Point, Long Island Sound										1	1
Gay Head, Martha's Vineyard				1					1		2
George's Island, Boston Harbor							1		1		2
Georges Island, Me					1						1
Georgetown Bay, S. C				3							3
Georgetown (outer bar), S. C								2		1	3
Gerrish Island, Portsmouth Harbor, N. H								1			1
Gilbert's Bar, Fla						1					1
Gilgo Inlet Bar (12 miles west of Fire Island), L. I										1	1
Gloucester, Mass								3	1	2	6
Glover Rock, Me									1		1
Goat Island, Cape Porpoise, Me								2		1	3
Goat Island Point, Me								1			1
Goat Island, R. I						1					1
Good Harbor Beach, Mass							1				2
Goose Falls, Brooksville, Me									1		1
Goose Island, Long Island Sound								1			1
Goshen Reef, Long Island Sound							1	2	1		4
Grace Point, Block Island, R. I					1						1
Grand Manan, near coast of Maine			1	2	2	1	1				7
Grand Manan (small island east of), near coast of Maine								1			1
Graves, Boston Harbor							3				3
Gray's Ledge, Me						1					1
Great Bay Light, N. J						1					1
Great Egg Harbor, N. J				1		1		1		1	4
Great Head (1 mile from Cutler, Me.)										1	1
Great Island Shoal, Portsmouth, N. H									1		1
Great Ledge, Mass						1					1
Great Rock, near Seaconnett, R. I								1			1
Great Point, Nantucket	2		1	3		1				1	8
Great Pond, N. J							1				1
Grecian Shoals, Fla						1					1
Green Island, Boston Harbor							1				1
Green Island Ledge, Me					1				1		2
Green Island Reef, Casco Bay								1	1		2
Green's Pond, Long Branch, N. J									1		1
Green Run, Md. (3 miles north-northeast from)										1	1
Green Run Inlet, Md							1		1	1	3
Greenport, N. Y										1	1
Grindstone Ledge (Muscle Ridge Channel), Me										1	1
Guilford, Conn							1				1
Gull Rock, Long Island Sound						1					1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Gull Rock, Newport Harbor							2				2
Gull Rock, Pamlico Sound									1		1
Gurnet, Mass									1		1
Guy's Ledge, Me						1					1
Hallet's Point, Hell Gate, N. Y									2		2
Hampton Bar, Va								1	1		2
Hampton Beach, N. H										1	1
Hampton Roads, Va									1		1
Handkerchief Shoal, Mass							2				2
Harbor Island, Me								1			1
Harding's (entrance to Boston Harbor)								1			1
Harding's Beach, Cape Cod Bay								1			1
Hart Island, Long Island Sound				1		2	1	2	2		8
Harwich Bar, Mass								1			1
Harwichport, Mass								1			1
Haskell Island, Me								1			1
Hatchett's Point, (1 mile west of)									1		1
Hatteras Inlet, N. C	5							2	4	3	14
Hatteras Light, N. C. (8 miles north of)								1			1
Hatteras Light, N. C. (20 miles north of)									1		1
Hatteras Shoal, N. C								1		2	3
Hatteras Swash, N. C. (2 miles from Inlet Light)								1			1
Hawes' Shoal, Vineyard Sound									1		1
Hawkins' Point, Chesapeake Bay							1				1
Hay Island Ledge, Seal Harbor, Me										1	1
Head Harbor Island, Me						1				1	2
Hedge Fence Shoal, Mass	1						2	1	2	1	7
Hell Gate, N. Y		3			2	4	6	3		2	20
Hell Gate (Steep Rock), N. Y								1	1		2
Hempstead, Long Island, N. Y						1					1
Hen and Chickens Reef, Del				1						1	2
Hereford Inlet, N. J						3	1	2			6
Heron Point (west of Whitehead, Me)										1	1
Herring Bay, Chesapeake Bay							2			1	3
Herring Gut, Me		1							2	1	4
Highland Light, Cape Cod						1			1		2
Highland Light, N. J. (3 miles from)								1			1
Highlands, N. J		1					1				2
Hillsborough Inlet, Fla									1		1
Hillsborough River, Fla						1					1
Hill's Point, Chesapeake Bay						1					1
Hodgdon Cove, Tremont, Me								1			1
Hodgdon's Ledge, Me									1		1
Hodge's Bar, Swan Point, Chesapeake Bay (near)										1	1
Hog Island, Va	2	3		1	3	3		3	2		17
Holland Point, Chesapeake Bay									1		1
Holmes' Hole, Mass						1	1				2
Hooper's Ledge, Herring Gut Harbor, Me										1	1
Hope Island, R. I				1							1
Horn Island, Mississippi Sound								1		1	2
Horn Point, Wicomico River (mouth of), Va										1	1
Horses' Race, Boston Bay						1					1
Horseshoe Shoal, Chesapeake Bay										1	1
Horseshoe Shoal, Nantucket Sound		1									1
Horton's Point, N. Y					1		1				2
Horton's Point, N. Y. (3 miles east of)								1			1
Horton's Point, N. Y. (7 miles west of)									2		2
Horton's Point, N. Y. (10 miles west of)								1			1
Horton's Point, N. Y. (12 miles west of)									1		1
Hough's Beach, Gloucester Harbor, Mass								1			1
Hunting Island, S. C						1			1		2
Huntington Neck, Long Island Sound							1				1
Hyannis, Mass								2	1		3
Hypocrites, Townsend Harbor, Me									1	1	2
Indianola, Tex			1		1			1			3
Indianola, Tex. (7 miles southwest of)								5			5
Indianola, Tex. (2 miles west of)								1			1
Indianola, Tex. (2 miles southwest of)								2			2
Indianola, Tex. (7 miles south of)								3			3
Indian Point, Cape Rosier, Penobscot Bay, Me									1		1
Indian River Inlet, Fla		1	1								2
Ingraham Point, Me						1					1
Inlet Shoals, N. J							2				2
Inman Bar, Nantucket			1								1
Ipswich Bar, Mass						2	4			1	7
Island Bank, N. J							1				1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Island Ledge, Mass	...	...	...	...	...	...	...	1	...	...	1
Islesborough, Me	1	...	...	...	...	...	...	...	...	...	1
Isles of Shoals, N. H	...	...	...	...	...	...	...	1	1	...	2
Jabez Rock, Guilford Harbor, Conn	...	...	...	...	...	...	...	...	1	...	1
Jackson's Creek, Va	...	...	...	...	...	...	...	...	1	...	1
Jamaica Island, Kittery, Me	...	...	...	...	...	...	...	1	...	...	1
James Ledges, Wickford, R. I	...	...	...	...	...	...	...	1	...	...	1
Jameson Point, Me	...	...	...	...	...	...	1	...	...	...	1
Jerry's Point, N. H	...	...	...	...	...	1	...	...	...	...	1
Jewell's Island Reef, Me	...	...	...	...	...	...	...	...	1	...	1
Joe Flogger, Delaware Bay	...	...	...	...	...	...	...	...	1	...	1
Jones' Beach, Long Island, N. Y	...	...	...	...	...	...	3	...	...	1	4
Jones' Hill, N. C. (near L. S. S. No. 4, District 6)	...	...	...	...	...	...	...	1	...	...	1
Jones' Inlet, Long Island, N. Y	...	...	1	1	...	...	1	...	2	...	5
Jonesport, Me	1	1	3	4	3	...	...	...	...	1	13
Jupiter Light, Fla	...	...	4	1	1	...	...	...	...	...	6
Jykill Island, Ga	...	...	...	...	...	...	...	...	1	...	1
Jykill Spit, Brunswick, Ga. (near)	...	...	...	...	...	...	...	...	...	1	1
Kegs Ledge, Muscongus Bay, Me	...	...	...	...	...	...	...	...	1	...	1
Kennebunkport, Me	...	...	...	...	...	...	...	...	...	1	1
Kent Island Narrows, Md. (2 miles from)	...	...	...	...	...	...	...	...	...	1	1
Kent Point, Eastern Bay, Md	...	...	...	...	...	...	...	...	...	1	1
Kettle Bottom Rocks, R. I	...	1	1	...	...	...	...	...	...	...	2
Key West, Fla. (18 miles northwest of)	...	...	...	...	...	...	...	...	...	1	1
Key West, Fla. (18 miles northeast of)	...	...	...	...	...	...	...	...	...	1	1
Key West, Fla. (southwest Point Quicksand)	...	...	...	...	...	...	...	1	...	...	1
Key West Harbor, Fla	...	...	...	...	...	...	...	...	1	...	1
Key West Island, eastern beach	...	...	...	...	...	...	...	...	1	...	1
Killpond Shoal, Mass	...	...	...	...	...	1	...	...	...	...	1
Kinnekeet, N. C	...	...	...	...	2	...	...	...	...	...	2
Kingfish Shoal, Fla	...	...	...	...	...	...	1	...	...	...	1
Kittery, Me. (ledge near)	...	...	...	...	...	...	...	...	...	1	1
Kittery Point, Me	...	...	...	...	...	...	...	2	...	...	2
Kittyhawk, N. C	...	...	...	...	...	...	...	...	1	...	1
Knowlton's Beach, Rockport, Mass	...	...	...	...	...	...	...	2	...	...	2
Lambert's Cove, Vineyard Sound	...	...	...	...	...	...	...	1	...	...	1
Lane's Island, Me	...	...	...	...	...	...	1	...	...	...	1
Last Island, Gulf of Mexico	...	...	...	...	...	...	...	1	...	...	1
Lattimer's Reef, Long Island Sound	...	...	...	...	...	...	1	...	...	1	2
Leete's Reef, Conn	...	...	...	...	...	...	...	...	1	1	2
Leighton's Point, Pembroke, Me	...	...	...	...	...	...	...	...	1	...	1
Lewes, Del	...	...	...	...	...	2	...	1	3	1	7
Lewistown, Del	...	...	...	...	...	...	...	1	...	1	2
L'Homme à Dieu Shoal, Vineyard Sound	...	...	...	...	...	1	...	2	...	2	5
Libby Island, Me	...	...	...	1	...	...	...	2	...	...	3
Little Beach, N. J	...	...	...	...	...	1	...	...	...	1	2
Little Cove Point, Chesapeake Bay	...	...	...	...	...	...	...	...	...	1	1
Little Cranberry Island, Me	...	...	...	...	...	...	1	...	...	...	1
Little Cumberland Island, Ga	...	...	...	...	...	1	...	...	...	...	1
Little Egg Harbor, N. J	...	1	...	3	...	1	...	4	...	...	9
Little Gull Island, Long Island Sound	...	...	...	...	...	...	...	1	...	...	1
Little Inlet, Long Island Sound	...	...	...	...	...	...	...	1	...	...	1
Little Island, Vineyard Haven	...	...	...	...	...	1	...	...	...	...	1
Little Moriches Beach, Long Island, N. Y	...	...	...	...	...	...	1	...	...	...	1
Little River Island, Me. (near light-house)	...	...	...	...	...	...	...	1	...	...	1
Little Round Shoal, Mass	...	...	...	...	1	...	...	...	...	...	1
Little Spoon Island, Me	...	...	...	...	...	...	...	...	1	...	1
Lloyd's Neck, Long Island	...	...	...	...	...	...	1	...	1	...	2
Lobster Rocks, Beverly Harbor, Mass	...	...	...	...	...	...	...	...	1	...	1
Lockwood's Folley, N. C	...	...	...	...	...	...	1	1	...	...	2
Londoner, The (near Thatcher's Island, Mass.)	...	...	...	...	...	...	...	...	...	1	1
Loggerhead Reef (south point of), Florida Reef	...	...	...	...	...	...	...	...	...	1	1
Long Beach Shoal, N. J	...	...	1	...	...	...	...	...	...	...	1
Long Branch, N. J	1	1	...	...	1	...	1	3	...	...	7
Long Island, Boston Harbor	...	...	...	...	...	...	...	...	...	1	1
Long Island coast (precise locality not stated)	2	4	2	1	...	...	...	1	...	...	10
Long Island Harbor Head, Islesborough, Me	...	...	...	...	...	...	...	1	...	...	1
Long Island Sound (precise locality not stated)	1	...	...	6	...	...	...	...	...	...	7
Long Land Shoal, Long Island Sound	...	...	...	...	...	...	...	...	1	...	1
Long Ledge, Seal Harbor	...	...	...	...	...	...	...	...	...	1	1
Long Shoal, Nantucket	...	...	...	...	...	...	...	...	2	1	3
Lookout Shoals, N. C. (northeast point of)	...	...	...	...	...	...	...	...	...	1	1
Lovell's Island, Boston Harbor	...	...	...	...	...	...	1	...	...	...	1
Lowell's Point, Me	...	...	...	...	...	2	...	...	...	...	2
Lower Clapboard Island Ledge, Me	...	...	...	...	...	...	...	1	...	...	1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Lower Hell Gate, Me						1					1
Lubec Narrows (Gun Rock), Me								1		1	2
Ludington Reef, New Haven Harbor								1			1
Ludlam's Beach, N. J. (near Corson's Inlet)									1	1	2
Lunging Island, Isles of Shoals, N. H								1			1
Lynn Haven Bay, Va						1			1	1	3
Machias, Me								1			1
Machiasport, Me		1						2			3
Machipungo Shoal, Va									1		1
Magothy River (mouth of), Chesapeake Bay										1	1
Main Inlet Bar, N. C. (2¼ miles northeast of)									1		1
Mansfield Ledge, Me. (entrance to Deer Island Thoroughfare)								1			1
Marblehead, Mass		2									2
Marblehead Neck, Mass								1			1
Mark Island Ledge, Penobscot Bay								1			1
Mark Island Reef, Me						1					1
Marsh Bank Bar, off Harwich, Mass								1			1
Marquesas, Fla						1	1	1	2		5
Matagorda, Tex. (10 miles southwest of)								2			2
Matagorda, Tex. (17 miles east of)								1			1
Matagorda, Tex. (7 miles south-southeast of)								1			1
Matagorda, Tex. (near Half Moon Reef Light)								1			1
Matagorda Bay, Tex					1	2		1			4
Matagorda Bayou, Tex								1			1
Matagorda Island, Tex								3		2	5
Matagorda Peninsula (6 miles from mouth of Caney Creek								1			1
Matinic Island, Me										1	1
Matinicock Point, Long Island									1		1
Menanktesuck Point, Conn						1					1
Merwin's Point, Conn									1		1
Metompkin's Inlet, Va									1		1
Metompkin Shoal, Va										1	1
Micomit Rip, Mass						1					1
Middle Ground, Chesapeake Bay										1	1
Middle Reef, near Woolsey's Point, L. I									1		1
Milk Island, Mass						1	1				2
Milk Creek Flats, Hampton Roads								1			1
Mishaum Point, Mass					1						1
Mispillion Creek, Del						1					1
Mobile, Ala. (3 miles south-southwest of)										1	1
Molasses Reef, Fla									1		1
Monhegan Island, Me. (southwest point of)								1			1
Monmouth Beach, N. J									1		1
Monomoy Point, Cape Cod			1					1	2		4
Montauk Point, Long Island		1								1	2
Mooseabeck Light, Mistake Island, Me							1		1		2
Mooseabeck Reach (entrance to Englishman's Bay), Me								1			1
Moose Island, Booth Bay Harbor, Me							1				1
Morris Cove, New Haven Harbor							1		1		2
Morris Island, S. C. (lower end of)										1	1
Mount Desert, Me			1								1
Munroe's Island, Penobscot Bay, Me									1		1
Muscle Ridges, Me							1				1
Muscle Ridge Channel, Me. (entrance to)								1			1
Muskeget Shoal, Nantucket Sound		1				1					2
Musquito Bar, Fla								1			1
Musquito Inlet, Fla			1	2					1	1	5
Musquito Island, Me							1				1
Mustang Island, Tex						1					1
Myrtle Island Beach, Va									1		1
Mystic, Mass							1				1
Nag's Head, N. C				1						1	2
Nantucket, Mass	3	1	1	1	2		4				12
Nantucket Bay, Mass. (south of Great Point)										1	1
Nantucket, Sankaty Light (near)										1	1
Nantucket Shoal (south side of)									1		1
Napatree Point, Conn								1			1
Napeague, Long Island									1		1
Nappertrice Point, Martha's Vineyard					1						1
Narragansett Pier, R. I					1	1				1	3
Nashawan Island, Vineyard Sound				2					1		3
Nash's Island, Me						1					1
Nassau Inlet, Fla						1					1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Nausett, Cape Cod	2			1		9	1	1	3	3	20
Naushon Island, Vineyard Sound								1		1	2
Navy Cove and Mobile Point (between), Miss							1				1
Negro Island (northeast side of), Saco Bay, Me								1			1
New Bedford Harbor, Mass							1		1		2
Newburyport, Mass						1	1				2
Newburyport Bar, Mass								1			1
Newcomb's Hollow, Mass								2			2
New Canal, Lake Pontchartrain (mouth of), La										1	1
New Haven, Conn		1					1	1	1		4
New Inlet, N. C		1					2		1		4
New Inlet, N. C. (5 miles north of)								1	1		2
New Inlet, N. C. (8 miles south of)									1		1
New Inlet, N. J							1				1
New Inlet, Long Island, N. Y								1			1
New Jersey coast (precise locality not stated)	1	3	1	1							6
New London, Conn					2				2		4
New London light-house, Conn									1		1
Newport, R. I							1		1		3
Newport News, Va									1		1
Nigger Island, Me						1					1
Nigger Point, Hell Gate, N. Y								2	1		3
Nix Mate, Boston Harbor									1		1
Nomineesset Island, Vineyard Sound							1				1
Norman's Woe, Cape Ann, Mass						1					1
North Bar, Hereford, N. J									1	1	2
North Breakers, mouth of Merrimac River, Mass								1	2	1	4
North Breakers, Mosquito Inlet, Fla								1			1
North Brother, Hell Gate, N. Y					1			1			2
North Inlet, S. C							1				1
North Point, Chesapeake Bay (3 miles southeast of)								1			1
Northport, Me									1		1
Norton Island, Seal Harbor, Me									1		1
Norton's Point, Carver Harbor, Me										1	1
Norton's Shoals, Mass						2					2
Norwalk, Conn										1	1
Norwalk Island, Long Island Sound							1				1
Noye's Point Rocks, R. I									1		1
Oak's Ledge, Mass						1					1
Ocean Beach, N. J										1	1
Ocean Grove, N. J						1			1	1	3
Ocean View, Va									1		1
Ocracoke Inlet, N. C					1				3	1	5
Odiorne Point, 2 miles south of Portsmouth, N. H									1		1
Old Cilley Ledge, Me							1	1			2
Oldfield Point Light, Long Island, N. Y										1	1
Old Inlet, Long Beach, N. J								1			1
Old Man Ledge, Me							1			1	2
Old Newton Rock, Mass		1									1
Oregon Inlet, N. C	5	7	1	7	3		1				24
Orleans, Cape Cod									2	2	4
Orr's Island, Me		1									1
Otter Island Ledge, Me								1		1	2
Owl's Head, Me						1	1				2
Oyster Beds Beacon, Savannah River								1			1
Oyster Bed Reef, N. Y							1				1
Oyster Island, N. Y						1					1
Oyster Rock, Wilmington Harbor, N. C									1		1
Padre Island, Tex										2	3
Palacios Point, Tex., Matagorda Bay										1	1
Pan Quoque, Long Island						1					1
Parker's Cove, Islesboro', Me									1		1
Parker's Island, N. Y										1	1
Parmet Hollow, Cape Cod										1	1
Pascagoula Bar, Miss							1				1
Pasque Isle, Vineyard Sound						2	3		1		6
Pass à l'Outre, mouth of Mississippi River						1	1				2
Pass Cavallo, Tex				1	1						2
Pass Cavallo Bar, Tex. (20 miles southwest of)								1			1
Pass Christian, Miss						1					1
Patience Island, R. I		1									1
Patuxent River (mouth of)									1		1
Pavilion Beach, Mass		1						2		1	4
Peaked Hill Bar, Cape Cod					1		2	1	1		5
Peck's Beach, N. J					1						1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Pelican Shoals, Fla				1			1	1			3
Pemaquid Light, Me						1					1
Pembroke, Me							1				1
Pensacola Bay (north shore of), Fla										1	1
Pensacola Bay Bar, Fla								1		1	2
Pensacola, Fla	1	1			2					2	6
Penikese Island, Buzzard's Bay										1	1
Pepperell's Cove, off Portsmouth Harbor									1		1
Perdido Bay Bar, Fla								1			1
Perdido Inlet, Fla		1									1
Perkins' Ledge, mouth of Kennebec River, Me							1				1
Perrico Shoal, Tampa Bay, Fla										1	1
Perry's Creek, Penobscot Bay										2	2
Perry Mill Wharf, Newport, R. I									1		1
Petit Manan, Me						1	1		1	1	4
Phipsburg Ledge, Me								1			1
Pickard's Point, Penobscot Bay							1				1
Pickle Reef, Fla									1	2	3
Pickle Reef and French Reef (between), Fla								1			1
Pigeon Point								1			1
Plum Gut, Long Island Sound							1				1
Plum Island, Long Island Sound					1					1	2
Plymouth, Mass					1						1
Point Allerton, Boston Harbor						1	1				2
Point au Fer, Fla							1				1
Point Gammon, Mass						1					1
Point Isabel, Tex							3				3
Point Judith, R. I				2		1	2	1	1		7
Point no Point, Chesapeake Bay										1	1
Pollock Rip, Mass							1	1			2
Pond Cove, Cape Elizabeth, Me									1		1
Pond Cove Island, Englishman's Bay, Me								1			1
Pond Island, Me								1	1		2
Pondquogue Light, Long Island								1			1
Poplar Point Light, R. I		1									1
Portland Head, Cape Elizabeth, Me								1			1
Port Jefferson, Long Island									1		1
Port Penn, Delaware Bay									1		1
Portsmouth, N. H									1	3	4
Pot Rock, Hell Gate									1		1
Powder Horn Bayou, Tex						1		2			3
Prince's Bay, Perth Amboy										1	1
Prospect Harbor								5			5
Provincetown, Cape Cod					4			5	2		11
Pulpit Harbor, North Haven								1			1
Pumpkin Hill Shoal, Charleston, S. C								1	1		2
Pumpkin Rock								1			1
Queenstown Creek, Md										1	1
Quogue, Long Island, N. Y				1	1						2
Quonochontaug Beach, R. I								1			1
Race Point, Fisher's Island, Long Island Sound									1		1
Race Point, Mass			1	1	1	3	2	4			12
Race Point (near Cutler), Me										1	1
Race Rock, Long Island Sound									1		1
Ragged Island, Penobscot Bay								1			1
Ragged Point, Assateague Island, Va										1	1
Ragged Point, Va., Chesapeake Bay										1	1
Ram Island, Me							1				1
Ram Island Reef, Long Island Sound									1		1
Ram's Head Ledge, Boston Harbor							1				1
Rand's Point, New Castle, N. H										1	1
Red Beach, Calais, Me										2	2
Red Fish Light, Tex. (2 miles east of)									1		1
Red Spring Point (near Glen Cove Dock), Long Island								1			1
Reedy Island, Delaware Bay								1			1
Revenue Point Shoal, Ala							1				1
Richmond Island, Me						1		1	1		3
Rip-Raps, mouth of Chesapeake Bay									1		1
Roberts Harbor, Me								1			1
Robinson's Hole, Vineyard Sound, Mass										1	1
Rockaway, Long Island		2			1	1			1		5
Rockaway Shoals, Long Island Sound								1	1		2
Rock Island Beach, Long Island, N. Y							1				1
Rock Point, Chesapeake Bay								1			1
Rockland, Me										1	1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Rockport, Mass						1					1
Rocky Point, Long Island Sound								1		1	2
Rocky Point, Mass						1					1
Romer Shoals, N. Y						1	1	3			5
Rose Landing, Long Island						1					1
Rudder Rock, Deer Island, Me								1			1
Rye Beach, N. H			1								1
Sabine Pass, La								1			1
Saddle Back Island, Penobscot Bay								1			1
Sail Rock, Lubec, Me			1								1
Saint Andrew's Bar, Fla			1								1
Saint Augustine, Fla										1	1
Saint Augustine Bar, Fla									1		1
Saint Augustine Light, Fla	1			1		1	1				4
Saint Catharine's Sound, Ga					1						1
Saint George's Island, Fla					1						1
Saint Helena Sound, S. C								1		1	2
Saint John's Bar, Fla	1					3	1		1	2	8
Saint Joseph's Island, Fla	1										1
Saint Mark's, Fla			1								1
Saint Simon's Bar, Ga				2		1					3
Saint Vincent Island, Fla										1	1
Salisbury Beach, Mass									1		1
Salt Island Ledge, Mass							1				1
Saluria Bayou, Tex								1			1
Saluria, Tex								1			1
Sand Beach (5 miles south of Cape Henlopen)									1		1
Sand Shoal Inlet, Va										1	1
Sandy Hook, N. J	1	1	2	1		4		4	1	3	17
Sandy Key, Florida Reef (near)										1	1
Sandy Point, Chesapeake Bay									4		4
San Luis Pass, Tex							4				4
San Luis Pass (2 miles northeast of), Tex										1	1
San Luis Pass (5 miles west of), Tex										1	1
Santa Rosa Island, Fla									1		1
Santa Rosa Island, Tex						1	1		1		3
Sapelo Shoals, Ga			1	2		1					4
Satilla River, Ga						1					1
Saugatuck, Conn		1									1
Saybrook Bar, Conn			2	2		1	1	1	2	8	12
Schoodic Island, Me										1	1
Scituate, Mass	1	2	1	1	3		3		2	3	16
Sculpin Rock, Me							1				1
Seaconnet Point, R. I								1			1
Seaconnet River (mouth of, west side), R. I								1			1
Sea Grove, Cape May, N. J									1		1
Seal Cove, Mount Desert, Me								1			1
Seal Harbor, Muscle Ridge Channel, Me										2	2
Seal Island Ledge, Me									1		1
Seal Island, Machias, Me										1	1
Seal Ledge, Me								1			1
Searsport Harbor, Me								1			1
Seavey's Island, Portsmouth Harbor, Me								1			1
Seven Mile Beach, N. J				1							1
Severn River (mouth of), Va										1	1
Sewell's Point, Va								1			1
Shabbit Island, Me							1				1
Shallotte Bar, N. C. (west side)									1		1
Shark River, N. J				2		1				1	4
Sheep's Head Bay Bar, Long Island						1					1
Sheepscot River (mouth of), Me										1	1
Shinnecock, Long Island								2	1		3
Ship Shoals, Va									1		1
Shippen's Reef, Long Island Sound				1		1	1				3
Shiverly Ledge (off Spruce Head), Me										1	1
Shore Island, R. I. (east of Portsmouth Grove)										1	1
Shovelful Light, Nantucket Sound			1								1
Shovelful Shoals, Cape Cod							1	3		1	5
Simonton Cove, Cape Elizabeth, Me								1			1
Sinepuxent, Md	1				1	1			1	2	6
Skinner's Head, Marblehead Harbor									1	1	2
Slocum's River (mouth of), Dartmouth, Mass										1	1
Smith's Island, Va		2			1			3		1	7
Smith's Island, Nantucket Shoals							1				1
Smith's Ledge, Conn		1				1					2

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Smith's Point, Chesapeake Bay						1					1
Smith's Reef, Long Island Sound						1					1
Smith's Rock, Scituate Neck, Mass									1		1
Smithtown, Long Island										1	1
Smithtown Bay, Long Island Sound									1		1
Smithtown Beach, Long Island Sound									1		1
Smithville, N. C						1					1
Snow's Flats, Me						1					1
Southampton, Long Island				1		1	1				3
South Breaker (off), Baker's Island, Mass										2	2
South Breakers, Ipswich, Mass								1			1
South Chatham, Mass										1	1
South Dennis, Mass				3							3
South Gardiner, Me										1	1
South Harbor, Me	1										1
South Marshfield, Beatte's Island, Me							1				1
Southern Island, Me. (near) Saint George										1	1
Southport Bar, Conn						1			1		2
Southport, Me						3					3
South Saint George, Me									2		2
Southwest Harbor, Me						1					1
Southwest Pass, mouth of Mississippi River									1		1
South Yarmouth, Mass	1										1
Sow and Pigs, Mass						1			1		2
Spectacle Island, Cumberland Inlet, Ga									1		1
Spouting Rock, R. I		1									1
Spruce Head, Me			1								1
Spruce Island, off Machias, south side of, Me										1	1
Spruce Point, Booth Bay Harbor, Me									1		1
Spruce Point Ledge, Me						1	1				2
Squan Beach, N. J		5		4	2	1	2	2	2	1	19
Squan Inlet Shoals, N. J				2							2
Squash Meadow Shoals, Vineyard Sound							2	1			3
Stage Island, Me						1		2			3
Stamford, Conn		1					1				2
Staten Island, N. Y				1			1	1	1		4
Steuben, Me	1										1
Stingray Point (mouth of Rappahannock River)								2			2
Stirrup Key, Florida Reef										1	1
Stone Beacon Ledge, Portsmouth Harbor									1		1
Stone Horse Shoal, Nantucket								1	1	1	3
Stone Horse Shoal (near Tybee Island, Ga)								2			2
Stone Rock, York River, Me									1		1
Stonington Harbor (Academy Grounds)								1			1
Stono Breakers (mouth of Stono River, S. C)								1			1
Stono Inlet, S. C								1			1
Stony Point, Cape Poge, Mass									1		1
Stratford Shoals, Conn						1			1		2
Succonnessett Light, Mass			1								1
Sullivan Falls, Me							1				1
Swampscott, King's Beach, Mass								2			2
Swampscott, Lincoln House Point, Mass								2			2
Sweet's Island, Sheepscot River (mouth of), Me										1	1
Tally's Point Reef, Chesapeake Bay										1	1
Tampa, Fla		3		1	1						5
Tanner's Point, Long Island (1 mile east of L. S. S. No. 15)										1	1
Tarpaulin Cove, Vineyard Sound						1	3				4
Taunton River (mouth of), Mass										1	1
Tenant Harbor, Me										1	1
Tenpound Island, Mass						1		2			3
Terry Ledge (off White Head Light), Me								1			1
Thames River, Conn. (near Comstock's Point)							1				1
Thatcher's Island, Mass								2			2
Thatcher's Island (near Londoner), Mass								1	2		3
Thatcher's Island, Me. (off)									1		1
Thimble Island, Long Island Sound							2				2
Thomaston, Me						1					1
Three Tree Island, Me							1				1
Thumb Cap Island, Mass							1				1
Timbalier Island, La. (west end of)										1	1
Tiverton, R. I										1	1
Toddy Rock (off Hull), Mass								1			1
Toos Point, Va						1	1				2
Tortugas, Fla								1	1		2

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

ATLANTIC COAST—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Tortugas, Fla. (southwest reef)									1		1
Townsend's Inlet, N. J	1					1	4	2			8
Townsend's Inlet, N. J. (3 miles south of)								1			1
Triangle Ledges, Me									1		1
Truro, Mass					1		1		1	1	4
Tubb Inlet, N. C						1					1
Tucker's Beach, N. J	1		1		1						3
Tuckernuck Shoals, Nantucket			2				2		2	1	7
Tupp's Inlet, S. C					1						1
Turner's Lump, Va						1					1
Turtle Gut Bar, Cape May									1		1
Turtle Inlet Bar, N. J					1					1	2
Two Brothers, Wickford, R. I							1				1
Two Bush Island, Me							1				1
Tybee Island, Ga							2			1	3
Vancock Shoals, Tex							1				1
Vineyard Haven Harbor, Mass					2		5	3		4	14
Ward's Island. N. Y					1						1
Warren Harbor, R. I					1						1
Warwick Neck, R. I		1									1
Watchapreague, Va								1			1
Watchapreague, Inlet, Va					1	2			1		4
Watchapreague Shoal, Va							2				2
Watch Hill, R. I				1		1					2
Watch Hill, R. I. (5 miles east of)								1			1
Webber's Ledge, Muscongus Sound, Me								1			1
Wellfleet, Cape Cod			1		3	1					5
Wells Beach, Me				1		1		1			3
West Chop, Vineyard Sound						1	2	9			12
West Dennis, Cape Cod						1					1
West Hampton Bar, L. I. (near L. S. S. No. 15)										1	1
West Harbor, Me						1					1
West Quoddy Bay (near Campobello), Me								1			1
West Quoddy Head, Me							1	1		1	3
West River, mouth of (Three Sisters) Chesapeake Bay								3			3
Western Dry Rocks, Fla									1		1
Westport Point (near), Mass										1	1
Whale Back Rock, Narragansett Bay								1			1
Whale Rock, R. I				1							1
Whale Rock Light, Me							1				1
Wheeler Bay, Me. (Red Ledge in)								1			1
White Head, Me						1	2				3
Wicomico River, Md. (mouth of)									1		1
Wilke's Ledge, Buzzard's Bay							1				1
Willoughby Shoal, Chesapeake Bay						1					1
Wilmington Bar, N. C						1					1
Windmill Point, Stonington, Conn								1			1
Winter Harbor, Me									1		1
Winter Quarter Shoals, Md			1			2	1	1			5
Winthrop Beach, Mass						1	1				2
Winyah Bay, S. C					1					1	2
Wire's Point, Onancock, Va								1			1
Wiscasset Ledge, Me					1						1
Wolftrap Shoal, Mob Jack Bay, Va								1		1	2
Wood End, Cape Cod							5	1	1	1	8
Wood's Hole, Mass								1			1
Wood Island, Me		1			1						2
Wood Island (near Biddeford Pool), Me										1	1
Woodward's Cove, Grand Manan, Me								1			1
York Beach, Me						1		1			2
York Ledge, Me							1		1		2
York Narrows, Me						1					1
York River, Me							1				1
Young's Point (entrance to Fox Islands Thoroughfare), Me.								1			1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

PACIFIC COAST.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Admiralty Inlet, Puget Sound								1			1
Albion River, Cal	1										1
Alcatraz Island, San Francisco Bay										1	1
Aquina Bar, Oreg								1			1
Arch Rock, Oreg	1										1
Arch Rock (½ mile east-northeast from Alcatraz Island)										1	1
Arestable Island, Alaska					1						1
Astoria, Oreg							1				1
Baker's Bay, Columbia River			1								1
Baker's Island, San Franiscso Bay	1		1								2
Bowen's Landing, Cal	2		1						2	1	6
Cape Blanco, Oreg		1									1
Cape Edgecombe, Alaska	1										1
Cape Flattery, Wash	1			1	1			1	1		5
Cape Foulweather (10 miles north of), Wash								2			2
Cape Pinos, Cal		1									1
Caprian Islands, Alaska								1			1
Carquinez Strait, Cal									1		1
Casper Creek, Cal			3								3
Casper River (mouth of), Cal								1			1
Clarence straits, Alaska			1								1
Clark's Island Reef, Washington Sound							1				1
Clatsop's Spit, Columbia River							1	1			2
Columbia River				1			2		1	1	5
Columbia River Bar										3	3
Cook's Inlet, Alaska	1		1	2							4
Coos Bay, Oreg	3	2				2					7
Coos Bay Bar, Oreg										1	1
Coos Bay Bar (9 miles north of), Oreg						1	1				2
Coquilla, Cape Arago, Oreg				1							1
Coquilla River (5 miles south of), Oreg									1		1
Cotteneva, Cal									1		1
Crescent Bay, Juan de Fuca Straits										1	1
Crescent City, Cal									1	1	2
Cuffey's Cove, Cal				1		1			1		3
Davenport's Landing, Cal	1			1							2
Destruction Island, Wash								1			1
Discovery Island, Straits of Juan de Fuca		1					1				2
Drake's Bay, Cal										2	2
Duncan's Landing, Cal							1				1
Dungeness Spit, Wash	1					1					2
Duxbury Reef, Cal						1	1			1	3
Eagle Harbor, North Point Shoal									1		1
Eel River, Cal. (mouth of)										1	1
Eel River Bar, Cal										1	1
Farallones, Cal				1			1				2
Fish Rock (near bluff), Cal							1			1	2
Fisk's Mill, Sonoma County, Cal								1			1
Fort Point, San Francisco Bay				1			1		1		3
Fort Ross, Cal							1				1
Fort Stephens, Oreg							1				1
Four Fathom Bank, Cal					1						1
Gerstler's Cove, Cal										1	1
Goleta, Cal										1	1
Half Moon Bay, Cal	2										2
Humboldt Bar, Cal			1							2	3
Hunter's Point, San Francisco Bay										1	1
Kake Island (north side of), Alaska						1	1				2
Kalwach, Alaska			1								1
Kodiak Harbor (21 miles southeast of), Alaska							1				1
Lime Point, San Francisco Bay										1	1
Little Alcatraz Rock, San Francisco Bay								1			1
Little River, Cal										1	1
Little River Head, Cal								1			1
Marrow Stone Point (northwest side of)								1			1
Mendocino, Cal	1			2						1	4
Mile Rock, entrance to San Francisco Bay		1							1	2	4
Mora Bay, Cal									2		2
Newport, Cal						1					1
North Farallon Island, Cal							1				1
North Head, San Francisco Bay							1				1
Novara River, Cal				1							1
Noyo River (mouth of), Cal										1	1
Ocean Side House, Cal					1						1
Ounga, Choumagin Islands, Alaska									1		1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

PACIFIC COAST—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Pajaro, Cal			1								1
Piedras Blancas, Cal		2									2
Pigeon Point, Cal	1										1
Pillar Point, Cal									1		1
Point Arena, Cal				1		1	1				3
Point Arena, Cal. (15 miles from)									1		1
Point Arena Harbor, Cal							1				1
Point Arena Light-House (near), Cal								1			1
Point Bonita, Cal				1							1
Point Bonita Light (2 miles north of), Cal										1	1
Point Diablo, Cal				1							1
Point Fermin, Cal				1							1
Point Gorda, Cal						1					1
Point Grenville, Wash						1					1
Point Hueneme, Cal			1								1
Point Lobos, Cal	1										1
Point of Rocks, Mission Bay, Cal										1	1
Point of Rocks, Wrangel, Alaska								1			1
Point Pedro, Cal	1			1							2
Point Reyes, Cal			2				1		1	1	5
Point Sal, Cal								1			1
Point Sur, Cal							1				1
Point Wilson, Wash								1			1
Port Orford, Oreg								1			1
Port Orford, Oreg. (15 miles south of)										1	1
Rincon Rock, San Francisco Bay				1							1
Rocky Point, Cal									1		1
Rogue River, Oreg							1				1
Rogue River (mouth of), Oreg								1			1
Rough and Ready (5 miles south of Point Arena)										1	1
Salmon Creek, Cal					1					1	2
Salt Point, Cal										1	1
San Buenaventura, Cal								3	1		4
San Diego Bay, Cal										1	1
San Francisco Bay				3		1					4
San Juan Harbor, Straits of Fuca						1					1
San Juan Passage, Wash									1		1
San Pablo Bay, Cal										1	1
San Pedro, Cal					1						1
Sand Island, Oreg						1		1			2
Sand Spit, Oreg		1									1
Santa Barbara, Cal	1										1
Santa Cruz, Light-House Point, Cal									1		1
Shoalwater Bay, Wash								1			1
Smith's Point (below Astoria), Oreg								1			1
Smith's River (mouth of), Cal										1	1
Soquel, Cal			1								1
South Beach, San Francisco Bay							1	1			2
South Beach, Yaquina Bay, Oreg								1			1
Stewart's Point, Cal			6					1			7
Stillwater Cove, Cal			1								1
Straits of Fuca		1					1				2
Timber Cove, Cal				1							1
Tomales Bar, Cal	1					1					2
Tomlinson's Reef, Wilmington Bay, Cal								1			1
Trinidad Harbor, Cal										1	1
Umpqua Bar, Oreg					2						2
Umpqua River (mouth of), Oreg						1		1			2
Water Bay Bar, Wash							1				1
Yaquina Bay, Oreg						1			1	1	3

LAKE COASTS.

[NOTE.—This list includes also places on the Canadian shore where American vessels have stranded.]

Name of place.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Ahnapee Harbor, Lake Michigan	1			1			1				3
Alabaster Reef, Lake Huron				1	1			1			3
Alcona, Lake Huron						1				2	3
Alexander Bay, Saint Lawrence River	1										1
Alpena, Lake Huron						2					2
Amherstburg, Lake Erie							2				2
Amsterdam, Lake Michigan			1								1
Apostle Island, Lake Superior	1						1				2

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.* Continued.

LAKE COASTS—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Ashtabula, Lake Erie			1		1		1	2	2		7
Au Sable River (mouth of), Lake Huron										1	1
Avon Point, Lake Erie							1				1
Bailey's Harbor, Lake Michigan		3	1					2			6
Barcelona Harbor, Lake Erie, N. Y									1		1
Bark River, Green Bay, Mich. (mouth of)									1	1	2
Bark Shanty, Lake Huron				1							1
Bar Point, Lake Erie	1	1	1	3	4	4	1	1		1	17
Bay Point, Lake Erie	1										1
Bay Quinte, Lake Ontario			2					1			3
Bear Harbor, Lake Michigan									1		1
Beaver Harbor, Lake Michigan									1		1
Beaver Island, Lake Michigan	2			3		2		1			8
Belle Island, Detroit River		1				4		1			6
Big and Little Sturgeon Point, Green Bay							1				1
Big Point au Sable, Lake Michigan			1								1
Big Sodus, Lake Ontario				1						2	3
Black Creek, Lake Michigan				1							1
Black River, Lake Erie	1		2	1		1					5
Black River, Lake Huron							2				2
Bois Blanc Island, Lake Erie								1			1
Bois Blanc Island, Lake Huron					2	2	1	2			7
Braddock's Point, Lake Ontario									1		1
Brant Pier, Lake Michigan	1										1
Brockville, Saint Lawrence River				1							1
Buffalo Harbor, Lake Erie			1	3	1	1	2	1	1	2	12
Burlington Beach, Lake Ontario				1							1
Burnt Cabin Point Reef, Lake Huron										1	1
Bury Inlet, Lake Huron	1										1
Buckhorn Dock, Lake Erie									1		1
Calumet (3 miles south of), Lake Michigan										1	1
Calumet Reef, Lake Michigan	2						1				3
Canna Island, Lake Michigan							1				1
Cape Hurd, Lake Huron				1							1
Carlson's Pier and Ellison's Bay (between)							1				1
Carlton Island, Saint Lawrence River					1						1
Carleton, Lake Michigan						1					1
Carp River, Lake Michigan		1									1
Cassidy's Reef, Lake Erie							1				1
Cataract Rock, Lake Ontario							1				1
Cathead Point, Lake Michigan							1				1
Cedar Point, Sandusky Bay, Lake Erie				1		2	1	1			5
Cedar Rapids, Saint Lawrence River				1							1
Cedar River, Lake Michigan			1					1			2
Chamber's Island, Lake Michigan				1		1					2
Chantry Island, Lake Huron	1										1
Charity Island, Lake Huron	2			1							3
Charlevoix, Lake Michigan									1		1
Charlotte (4 miles west of), Lake Ontario										1	1
Charlotte Harbor, Lake Ontario							1	1			2
Cheboygan, Straits of Mackinac						1		4		1	6
Chester's Reef, Lake Erie							1				1
Chicago (5 miles south of)										1	1
Chicago Harbor, Lake Michigan	10	2		3	1	1	1	6		2	26
Chicanore Reef, Lake Erie						1					1
Chocolay River (one mile east of), Lake Superior									1		1
Chuckaluna Reef, Lake Erie		1	1		1						3
Clay Banks, Lake Erie				2	1	1					4
Clay Banks, Lake Michigan							1	1			2
Cleveland Harbor, Lake Erie	3	2	5	1		3	1	2		1	18
Coburg, Lake Ontario		2	1								3
Cockburn Island, Lake Huron				1							1
Colchester Reef, Lake Erie	1	2	1	1	1		1				7
Collingwood, Lake Huron		1									1
Conneaut, Lake Erie				2							2
Cove Island, Lake Huron			3			1					4
Crib Reef, Lake Erie									1		1
Crow Island, Saginaw River					1						1
Death's Door, Lake Michigan			1			1	1	1	1		5
Detour, Lake Huron (18 miles from)										1	1
Detour, Lake Huron (Saint Mary's River)	1			3			1			1	6
Detour, Lake Huron (4 miles east of)										1	1
Detroit, Detroit River							1				1
Detroit Island, Lake Michigan	1	1									2
Detroit River	6	1			2		2			2	13

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

LAKE COASTS—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Devil's Nose, Lake Ontario			1								1
Devil's River, Lake Huron		1									1
Dorney's Reef Point, Lake Michigan							1				1
Dover Bay, Lake Erie				1							1
Drummond Island, Lake Huron		1									1
Duck Island, Lake Ontario					1						1
Duluth, Lake Superior					1						1
Dunkirk Harbor, Lake Erie			3	1			2	1			7
Dykesville, Lake Michigan				1							1
Eagle Harbor, Lake Superior	1				1	1					3
East Hamburg (8 miles west of Buffalo), Lake Erie										1	1
East Sister Island, Lake Erie			1	1	1						3
Eleven-Foot Shoals, Green Bay				1			1				2
Elk Island, Saint Clair River		2									2
Ellison's Bay, Wis									1		1
Ellsworth River, Lake Michigan					1						1
Elm Reef, Lake Michigan			1								1
Emmitsburg, mouth Detroit River										1	1
Erie Harbor, Lake Erie	2	2	3	3	2		2	1		1	16
Escanaba, Lake Michigan				1				1			2
Euclid, Lake Erie				1							1
Evanston, Lake Michigan	2				2	2					6
Fairport Harbor, Lake Erie			1	1		1	2	1		1	7
False Ducks, Lake Ontario					1						1
False Presque Isle, Lake Huron			1					2		2	5
Featherbed Shoals, Lake Ontario							1				1
Ferrer's Point, Lake Ontario		1									1
Fighting Island, Detroit River	1						1				2
Fisherman's Shoals, Lake Michigan								1			1
Fitzgerald Island, Lake Huron				1							1
Forest Bay, Lake Huron							1				1
Forrester, Lake Huron				1							1
Fort Niagara, Lake Ontario				1							1
Fort Shoals, Lake Ontario						1					1
Forty-Mile Point, Lake Huron				1			1		1	1	4
Forty-Mile Point (8 miles southeast by east from), Lake Huron										1	1
Four-Mile Point, Lake Ontario										1	1
Frankfort, Lake Michigan					2	1	1	2			6
Frankfort, Lake Ontario						2					2
Galloo Island, Lake Ontario										1	1
Gallop Rapids, Saint Lawrence River	1			1	1						3
Garden Island, Lake Ontario					1						1
Genesee River, Lake Ontario				1							1
Genesee, Lake Huron				1							1
Geneva (off), Lake Erie							1				1
Good Harbor Bay, Lake Michigan								2			2
Goodrich, Lake Huron			1	1	1						3
Grable's Point, Lake Erie							1				1
Graham's Shoals, Lake Michigan	1		1	1	1	1	1				6
Graham's Shoals (near), Straits of Mackinac										2	2
Grand Haven, Lake Michigan	5		2	1		6	1	6	1	1	23
Grand Island, Lake Superior		3	2		1	1	1	1	1		10
Grand Marrais, Lake Superior								1			1
Grand River Harbor, Lake Michigan (4 miles north of)										1	1
Grand River, Lake Erie					1	1					2
Grand River, Lake Michigan							2		1	1	4
Gray's Reef, Straits of Mackinac	1										1
Green Island (7 miles west of), Lake Erie										1	1
Green's Reef, Lake Erie				1							1
Griffith's Island, Lake Huron					1						1
Grimes' Reef, Lake Michigan	1										1
Grindstone City, Lake Michigan								1	1		2
Grosse Island, Detroit River	1	1				1		1	1		5
Grosse Point, Lake Michigan			1	1							2
Gull Island, Lake Ontario							1				1
Gull Island Shoal, Lake Michigan										1	1
Gull Point, Lake Ontario				2							2
Hammond's Bay, Lake Huron	1	3		1	1	1					7
Harrisville, Lake Huron	1	1								1	3
Hat Island, Lake Michigan			1								1
Hat Island Reef, Green Bay							1				1
Herson's Island, Saint Clair River	2		1				1			1	5
Highland Reef, Lake Michigan		1									1
Hog Island, Lake Saint Clair							1				1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

LAKE COASTS—Continued.

Name of place.	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
Hog Island Reef, Lake Michigan		1	1	1							3
Holland, Detroit River							1				1
Holland, Lake Michigan		1			1			1	1	1	5
Horn's Pier (locality unknown)					1						1
Horseshoe Island, Lake Superior (supposed)							1				1
Houghton Centre, Lake Erie	1										1
How Island, Lake Ontario				2							2
Huron City, Lake Huron			1								1
Huron Island, Lake Superior								1			1
Hyde Park (off), Lake Michigan										1	1
Inverhuron Harbor, Lake Huron							2				2
Isle Royale, Lake Superior					1				1		2
Jacksonport, Lake Michigan (40 rods north of)										1	1
Johnson's Island, Saint Lawrence River							1				1
Kalamazoo River, Lake Michigan	1										1
Kederhouse Pier, Lake Michigan	1										1
Kelley's Island, Lake Erie		1			1	2	1	1			6
Kenosha, Lake Michigan				2		1	1		1		5
Kettle Point, Lake Huron			1	1							2
Kewaunee, Lake Michigan	2	1		1		2		1			7
Keweenaw Bay, Lake Superior									1		1
Kincardine, Lake Huron		1		4							5
Lake George Flats, Sault River							1				1
Langley's Pier, Lake Michigan						1					1
Latman Point, Lake Ontario			1								1
Laughing White-fish Reef, Lake Superior				2							2
Leamington, Lake Ontario								1			1
Leland, Lake Michigan				3	1					1	5
Lexington, Lake Huron	1							1		1	2
Lime Kiln Reef, Detroit River					2	4	3	2	1	2	14
Limestone Island, Georgian Bay									1		1
Little Bay de Noquet, Lake Michigan		1									1
Little Graham Shoals, Straits of Mackinac						1					1
Little Manitou Island, Lake Michigan							1				1
Little Sister Reef, Lake Michigan						1					1
Little Sturgeon Bay, Lake Michigan								1			1
Lone Rock, Lake Michigan								1			1
Long Island, Lake Ontario						1					1
Long Point, Lake Erie	3	8	7	6	2		5	2		3	31
Long Point, Lake Erie (12 miles west of)										1	1
Long Tail Point, Green Bay, Lake Michigan										1	1
Louse Island, Lake Michigan	1										1
Ludington, Lake Michigan			2		2		1				5
Mackinac, Straits of	16	3	4			1					24
Mackinac City, Lake Michigan								1		1	2
Madison, Lake Erie				1							1
Malden, Detroit River						1	1				2
Malden, Detroit River (2 miles south of)										1	1
Mammy Judy Light, Detroit River			1								1
Manistee Harbor, Lake Michigan		2	2		1	2	1	2	1		11
Manitou, Lake Michigan	2				1						3
Manitowoc, Lake Michigan							1	3			4
Marblehead, Lake Erie					1					1	2
Marblehead and Catawba Island (between)									1		1
Marquette, Lake Superior		1			2	2					5
Maumee Bay, Lake Erie					1						1
Michigan City, Lake Michigan					2	1	2	1		2	8
Michigan City (6 miles east of), Lake Michigan										1	1
Michipicoton, Lake Superior					1						1
Middle Bass Island, Lake Erie							1				1
Middle Island, Lake Huron	5	1			1	1					8
Middle Sister Island, Lake Erie	1	1			2						4
Middle Village, Lake Michigan										1	1
Milwaukee, Lake Michigan	2	4	2		1	2	1	2		1	15
Minerva, Lake Erie	1										1
Mission Point, Lake Michigan								1			1
Mission Reef, Lake Michigan			1								1
Morgan's Point, Lake Erie				1	1		1		1		4
Morrisburg, Lake Ontario							1				1
Mud Lake (near Bidwell, Chicago)							1				1
Muskegon, Lake Michigan	3	1	1		2	3	1	1	1	1	14
Napanee, Lake Ontario			2								2
Neebish Rapids, Saint Mary's River		1		1	1	4	4	1			12
New Buffalo, Lake Michigan		1	1					1			3
New Castle, Lake Ontario	1										1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

LAKE COASTS—Continued.

Name of place	Fiscal year ending June 30—										Total.
	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	
New Cut (5 miles below), Long Point, Lake Erie										1	1
New River, Lake Huron	1										1
Niagara Reef, West Sister Island, Lake Erie									1		1
Niagara River, Lake Erie				1		1					2
Nicholson Island, Lake Ontario				1							1
Nine-Mile Creek, Lake Ontario				2							2
Noon Point, Lake Huron		1									1
North Bass Island, Lake Erie		1									1
North Bay, Lake Michigan		1		1			1	1			4
North Harbor Reef, Lake Erie		1		2			2				5
North Manitou, Lake Michigan	1	3	1	1		4	1	2	2		15
North Point, Lake Huron										3	3
North Point, Lake Michigan		1			2	1					4
North Point Reef, Lake Huron										1	1
Northport, Lake Michigan	1	3		1							5
Oak Point, Lake Ontario						1					1
O'Connell's Pier, Lake Michigan									1		1
Oconto Reef, Lake Michigan								1			1
Old Mackinac Point, Lake Huron								3	1		4
Ole Antrim, Lake Michigan							1	1			2
Oswego, Lake Ontario		1	5	2	3	1		1	2		15
Owen Sound, Georgian Bay, Lake Huron	1			1							2
Pancake Shoal, Lake Michigan				1							1
Papoose Island, Lake Huron					1						1
Peach Orchard Reef, Lake Erie									1		1
Peche Island, Lake Saint Clair							1				1
Peninsula Point, Lake Erie								1			1
Peninsula Point, Lake Michigan								1			1
Peninsula Reef, Lake Michigan		1									1
Pentwater, Lake Michigan	1			2		2					5
Perry's Pier, Lake Michigan								2			2
Peshtigo Reef, Lake Michigan					1	1	1				3
Picton, Lake Ontario				1							1
Pigeon Bay, Lake Erie	1					2				1	4
Pigeon Bay, Lake Huron				1							1
Pigeon Island, Lake Ontario			1	1			1				3
Pigeon Point, Lake Erie										1	1
Pillar Point, Lake Ontario				1							1
Pilot and Detroit Isle, Lake Michigan					1						1
Pilot Island, Lake Michigan	2			1	1	1		1		2	8
Pine River, Lake Michigan						1				1	2
Pinnepoy, Lake Huron		2									2
Pike Island, Lake Michigan					1						1
Plum Island, Lake Michigan	2						1	1		1	5
Point Albino, Lake Erie		2		2			3				7
Point au Pelée, Lake Erie	6	2	3	11	5	4	3	3		2	39
Point au Pelée Island, Lake Erie										2	2
Point au Sauble, Lake Huron	1				3						4
Point au Sauble, Lake Michigan				1				1			2
Point aux Barques, Lake Huron	3		1	2		1	1	1		1	10
Point aux Pins, Lake Erie					1						1
Point Betsey, Lake Michigan			2		1						3
Point Clark, Lake Huron, Canada								1			1
Point Dalhousie, Lake Ontario								1			1
Point Edwards, Lake Huron			1	2			1				4
Point Elgin, Lake Huron			2								2
Point Frederick, Lake Ontario	2		2								4
Point La Barbe, Straits of Mackinac								1			1
Point Moullier, Lake Erie							1				1
Point Peninsula, Lake Michigan			1								1
Point Peninsula, Lake Ontario	1								1		2
Point Permit, Lake Erie						1					1
Point Peter, Lake Ontario		1									1
Point Sanilac, Lake Huron						1					1
Portage Canal, Lake Michigan			1								1
Portage Canal, Lake Superior			1								1
Portage, Mich									1		1
Portage River, Lake Superior		1					1				2
Port Austin, Lake Huron		1		1		1	1	1			5
Port Austin, Lake Huron (1 mile west of)										1	1
Port Austin Reef, Lake Huron							1	1			2
Port Austin Reef, Lake Michigan				2						1	3
Port Bruce, Lake Huron	1				2						3
Port Burwell, Lake Erie	1		2	1	2	1		1			8
Port Colborne, Lake Erie	4	3	3	2	1		1			1	15

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

LAKE COASTS—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Port Crescent, Lake Erie					1						1
Port Glasgow (off), Lake Ontario										1	1
Port Hope, Lake Huron				1							1
Port Huron, Saint Clair River	2	1									3
Port Maitland, Lake Erie		1			2		4				7
Port Ryers, Lake Erie										1	1
Port Sanilac Bar, Lake Huron										1	1
Port Stanley, Lake Erie	1			1	1						3
Port Washington, Lake Michigan		1	1				1				3
Poverty Island, Lake Michigan	1				1					1	3
Presque Isle Bay, Lake Huron	1	2	1	3							7
Presque Isle, Lake Erie					2					1	3
Presque Isle, Lake Huron						1	1			2	4
Put-in Bay, Lake Erie				1			1				2
Racine, Wis									3		3
Racine Reef, Lake Michigan	3	2	3	3	2	2	2	1		1	19
Rock Falls, Lake Huron							2				2
Rock Island, Lake Michigan						1					1
Rondeau, Lake Erie	2	2			6						10
Ronk's Pier, Lake Michigan						1					1
Round Island, Lake Michigan			1	1							2
Saginaw River, Saginaw Bay, Lake Huron							1				1
Saint Clair Flats, Lake Saint Clair	4		1				2			1	8
Saint Clair River			1			1					2
Saint Helena, Straits of Mackinac	3		2		2			1		1	9
Saint Joseph, Lake Michigan	2	1		3	2	1		3	2	2	16
Saint Lawrence River	2			1	1	1					5
Saint Martin's Island, Lake Michigan			1			1					2
Saint Mary's River	2		1	2	1	2					8
Salmon's Point, Lake Ontario			1								1
Sand Bay, Lake Ontario								1			1
Sand Beach, Lake Huron	1						1			2	4
Sandy Creek, Lake Michigan				1							1
Saugatuck, Lake Michigan					1						1
Sault Sainte Marie (1 mile above)										2	2
Sault Sainte Marie Canal			2								2
Scholie's Point, Lake Erie							1				1
Sheboygan, Lake Michigan	2			3	2	1	2	1			11
Silon Creek, Lake Erie			1								1
Sister Bay, Wis									1		1
Sister Island, Lake Michigan								1			1
Skillagalee, Lake Michigan									1		1
Sleeping Bear Point, Lake Michigan			1				1	1			3
Snake Island, Lake Ontario	2			2							4
South Bay, Lake Ontario			1	1							2
South Fox Island, Lake Michigan	1					1					2
South Haven, Lake Michigan		1	1		1		1	4			8
South Manitou, Lake Michigan				1	1		1	5	2		10
South Point Island, Lake Michigan					1						1
South Reef, Lake Michigan	1										1
South River, Lake Huron		1									1
Spider Island, Lake Michigan					2					1	3
Starve Island, Lake Huron					1						1
Starve Island Reef, Lake Erie							2	1		1	4
Steam Mill Point, Lake Champlain								1			1
Stony Creek, Lake Michigan		2		1							3
Stony Island, Detroit River	2	1			1		1				5
Stony Point, Lake Ontario									2		2
Strawberry Island, Green Bay				2							2
Sturgeon Point, Lake Erie				1	1						2
Sturgeon Point, Lake Huron				1			1				2
Sturgeon Point Reef, Lake Erie							1				1
Sugar Island, Lake Huron				2						1	3
Sumner and Squaw Island (between), Lake Michigan							1				1
Taintor Island, Lake Ontario						1					1
Tawas Bay, Lake Huron	1			1	2	1					5
Tawas Point, Lake Huron							1				1
Tecumseh, Lake Erie	2										2
Thames River					1						1
Thunder Bay, Lake Huron		1	1		1				2	2	7
Tibbit's Point (entrance to Kingston), Lake Ontario										1	1
Timber Island, Lake Huron					1						1
Topsail Island Reef, Saint Mary's River										1	1
Toronto Piers, Lake Ontario (west of)									1		1

TABLE 65.—*List of places on the coasts of the United States where vessels have stranded, &c.*—Continued.

LAKE COASTS—Continued.

Name of place.	Fiscal year ending June 30— 1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	Total.
Toronto Point, Lake Ontario	3		1					1			5
Turtle Island, Lake Erie				1							1
Twin River Point, Lake Michigan								1			1
Two Creeks, Lake Michigan								1			1
Two Rivers, Lake Michigan		1	1	2							4
Vail's Reef, Lake Huron		1									1
Vermillion Point, Lake Superior		1		1							2
Washington Island, Lake Michigan			1	1		1					3
Waugoshance, Lake Michigan			1					3			4
Waukegan Pier, Lake Michigan	1				1		1	2			5
Welland Canal				1			1		1		3
West Vermillion, Lake Erie (¾ mile west of)										1	1
Whale's Back Shoal, Lake Michigan					1						1
White Fish Point, Lake Superior (9 miles above)									1		1
White Hall, Lake Michigan			1		1			1		1	4
White Lake Pier, Lake Michigan						3	1			1	5
White Rock, Saginaw Bay							1				1
White Shoals, Straits of Mackinac	1		1	2							4
Willard's Bay, Lake Ontario							1				1
Wilson Harbor, Lake Ontario			1				1				2
Wind Point, Lake Michigan								1	1		2
Windmill Point, Lake Erie			3								3
Wolf Island, Lake Ontario			1								1
Wood Island, Lake Michiaan								1			1
Woodward's Bay, Lake Michigan					1						1
Yates' Pier, Lake Ontario						1					1

TABLE 66.—*List of places where American vessels have stranded in* FOREIGN WATERS *during the fiscal years ending June* 30, 1875, *June* 30, 1876, *June* 30, 1877, *and June* 30, 1878.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Abaco, (Grand Cay Reef), Bahamas				1	1
Abaco Island (Bone Fish Bay), Bahamas		1			1
Abaco Island (Green Turtle Key), Bahamas		1			1
Abaco Island (Powell's Key), Bahamas		1			1
Abaco Island (Wood Key) Bahamas		1			1
Abaco light (15 miles north of), Bahamas				1	1
Abraham's Bay, Monguana Island		1			1
Adacora, Venezuela				1	1
Altalta (on sand beach 20 miles north), Mexico	1				1
Altalta (off), Mexico				1	1
Altalta Harbor, Mexico				1	1
Alvarado (25 miles east of), Mexico		1			1
Amherst Island, Gulf of Saint Lawrence	1	2			3
Anagada Reef, British West Indies				1	1
Anguilla Island (Salt Key Bank), Straits of Florida	1				1
Argyle (Old Man), Nova Scotia		1			1
Arogant Shoal (latitude 5° 17′ south, longitude 113° 29′ east)		1			1
Bahamas			2		2
Bahama Bank			1		1
Balahare Island (one of the Hebrides)				1	1
Baracoa Harbor, Cuba			2		2
Barbadoes (latitude 58° 40′ west)		1			1
Barbaretta Island, Honduras			1		1
Barbuda Island, West Indies		1			1
Barclay Sound (southwest end of Tyaartoos Island), British Columbia.		1			1
Bay of Fundy				1	1
Bay of Saint George, Newfoundland		1			1
Bay of Saint Lawrence			1		1
Belfast, Carrickfergus Bank, Ireland		1			1
Belize, main reef, 30 miles off		1			1
Benoit's Cove, Newfoundland				1	1

TABLE 66.—*List of places where American vessels have stranded* IN FOREIGN WATERS, *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Bermuda		2	2		4
Black Point and Seven Hills, Honduras, Central America	1				1
Boiling Reef, Gulf of Georgia	1				1
Bolton Island, Molucca Group, East Indies	1				1
Bonacca Harbor, Honduras, Central America	1				1
Brara Island, Cape de Verde Island		1			1
Brazil (latitude 5° 2′ south, longitude 35° 22′ west)				1	1
Brier Island, Northwest Ledge, Canada		1			1
Brier Island, Pond Cove, Nova Scotia		1			1
Buckos Reef, Tobago, British West Indies	1				1
Caicos Island, West Indies				1	1
Caicos Reef (north of), Bahamas		1	1		2
Cape Agulhas (15 miles north of), Africa			1		1
Cape Bollard, Newfoundland				1	1
Cape Breton Island		2		1	3
Cape Frio (60 miles from Rio)				1	1
Cape Hogan, Arichat Island, Nova Scotia		1			1
Cape Horn				1	1
Cape Isabella, San Domingo			1		1
Cape Negro (25 miles east of Rio Janeiro)		1			1
Cape Negro Island, Nova Scotia	1		1		2
Cape Sable, Nova Scotia	1				1
Cape Saint Mary, Newfoundland			1		1
Cape Saint Mary, Newfoundland (5 miles south of)				1	1
Cape Verde Island		2			2
Cardenas, Cuba			3		3
Cariaco, Gulf of Venezuela			1		1
Caribbean, near reef, Cuba		1			1
Carimata Straits, East Indies	1				1
Carlisle Bay, Barbadoes		1			1
Carnavon Bar, North Wales (near Llanenddwyn Point)				1	1
Cay Bars, Little Bahamas			1		1
Cay Largo, West Indies			1		1
Cette (near), France				1	1
Charlottetown Harbor, Prince Edward Island				1	1
Cheticamp, Cape Breton			1		1
Chickotan Island, Kurile Islands, Asia			1		1
China Sea			2	1	3
Chincorro Reef (90 miles north of Belize)		1			1
Cienfuegos Harbor (west head of), Cuba		1	1		2
Coatzacoalcos River (on Sand bar), Mexico		1			1
Cockburn Harbor Shoal, E. C		1			1
Colonia Harbor Rock, South America	1				1
Colorado Reef, Cuba	1		2		3
Colorado Reef, Lord Howe's Island, Australia			1		1
Comacho Bay, Peru			1		1
Constantinople (near), Turkey		1			1
Coral Island, Japan Bay				1	1
Corn Island, Central America	1				1
Coxyde, Belgium				1	1
Crooked Island, Bahamas	1				1
Crooked Island and Passage, near Castle Islands, West Indies		1			1
Dartmouth, England			1		1
Demas Key (Salt Key Banks), West Indies		1			1
Dona María Inlet, Cuba	1				1
Dugeon Shoal, Yorkshire, England		1			1
East London, Africa			1		1
Emulous Ledges, Nova Scotia				1	1
English Bank (probably), Bristol Channel	1				1
Ensenada, mouth of, Bristol Channel, Argentine Republic			1		1
Fiji Islands, northeast group			1		1
Flores Islands		1			1
Flushing, mouth of West Scheldt, Holland				1	1
Formentera, Balearic Islands		1			1
Frenchman's Harbor, south side Isle of Ruatan		1			1
Garrucha Roadstead, Spain				1	1
Gibraltar		1			1
Giegler Light, near		1			1
Gonaives Island, West Indies			1		1
Goodwin Sands, England			1		1
Grand Bahama	1		2		3
Grand Cayman, West Indies				1	1
Grand Sands, near Trieste			1		1
Grand Turk, northeast of reef		1			1

TABLE 63.—*List of laces where American vessels have stranded* IN FOREIGN WATERS, *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Greytown, Nicaragua				1	1
Grindstone Island, New Brunswick	1				1
Guanabana (10 miles north of Matanzas), Cuba				1	1
Gull Island, Long Harbor, Newfoundland			1		1
Gull Island, Nova Scotia	1				1
Hake, South Banks, Nieuwe Diep				1	1
Halifax, Nova Scotia			1		1
Hammond's Knoll (off Yarmouth Head)		1			1
Harbor Island, Bay of Islands, Newfoundland			1		1
Havana and Matanzas (between), Cuba		1			1
Hayo Main Rock, Bay of Yeddo, Japan		1			1
Hesquot Sound, Vanconver's Island	1				1
Hogsty's Reef, Bahamas			1		1
Honduras (near Truxillo), Central America				1	1
Hong-Kong, China	2				2
Hoogly River, Diamond Harbor, British India	1				1
Hudson Bay			1		1
Indian Island, Labrador		1			1
Jacquemel Bay, Hayti		1			1
Jardinillos Reef, West Indies		1	1		2
Jarvis Island, South Pacific				1	1
Jeremie Harbor, West Indies			1		1
Jig Rock, near Shelburne, Nova Scotia			1		1
Kaloot Bank, Holland		1			1
Kamschatka, Sea of Okhotsk			1		1
Lavendera Shoal, Matanzas Harbor		1			1
Lemoig, Jutland			1		1
Leones Islands, Montego Gulf, Jamaica	1				1
Liberty Point, Campobello Island, New Brunswick	1				1
Liscomb Harbor, Nova Scotia				1	1
Little Curaçoa, Caribbean Sea				1	1
Liverpool, England			1		1
Lockport Harbor, Nova Scotia (ledge off)				1	1
Lockville, Geography Bay, West Australia	1				1
Los Palmos, Canary Islands			1		1
Macassar Straits, East Indies	1				1
MacNutt's Island, Nova Scotia		1			1
Madison Island		1			1
Madeira Island		1			1
Magdalen Island, Gulf of St. Lawrence		1			1
Malpec Bar, Gulf of St. Lawrence	1				1
Mainadieu Reef, Cape Breton			1		1
Maquabo, Porto Rico			1		1
Marfa Drychon Beach, Cardigan Bay, Wales	1				1
Mariguana Island, West Indies		1			1
Mariguana Reef, Bahamas	1				1
Matane (2 miles west of), St. Lawrence River				1	1
Matanilla Reef, Bahama Banks			1		1
Matanzas Harbor, Cuba			1		1
Mayo Island, Cape Verde Group	1				1
Mazatlan, Mexico				1	1
Mexico (coast of)			1		1
Middle Wolf, New Brunswick (southern point of)			1		1
Mistaken Point, Newfoundland			1		1
Monte Rugginore (east of Sardinia)		1			1
Morant Cays, West Indies				1	1
Moselle Shoals, Bahamas	1				1
Murder Island Ledge (near Yarmouth), Nova Scotia			1		1
Musquash, Bay of Fundy, New Brunswick			1		1
Nag's Head, Louisburg, Cape Breton		1	1		2
Neiva, St. Domingo, and Navassa (between)				1	1
Neptune Shoal, Batavia Harbor			1		1
Nevis, Windward Islands				1	1
New Harbor Point, Nova Scotia				1	1
Newport Roads, Wales		1			1
Noel's Point Reef (entrance St. George's Harbor)		1			1
No Name Cay, near Abaco, West Indies				1	1
North Bimini, Bahamas			1		1
Nuevitas Harbor, Cuba		1		1	2
Pabillon de Pica, South America			1		1
Palance Shoals (near Manila)		1			1
Para River (mouth of), South America	1				1
Point Castilla, Honduras, Central America				1	1
Point Negro and Point Race (between), South America			1		1

TABLE 63.—*List of places where American vessels have stranded* IN FOREIGN WATERS *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Ponce, Porto Rico and St. Thomas (between)				1	1
Popa Island, Pacific Ocean (Malay Archipelago)			1		1
Porter's Passage (east side of), Halifax, Nova Scotia			1		1
Port Maria, Jamaica	1				1
Porto Rico, West Indies			1		1
Progresso, Mexicoo		1			1
Prospect, Nova Scotia		1			1
Quoin Point, Cape Good Hope, Africa		1			1
Quronata, coast of, Spanish Honduras				1	1
Rocas Reef (125 miles northwest of Cape Saint Roque), Brazil	1				1
Rocky Reef, Point Carlisle Bay, Jamaica				1	1
Rum Cay, Bahamas		2			2
Sable Island, Nova Scotia		2			2
Saint George, New Brunswick	1				1
Saint John's, Porto Rico			1		1
Saint Lawrence Bay				1	1
Saint Mary's Bay, Nova Scotia	1				1
Saint Pierre, Newfoundland			1		1
Saint Thomas Harbor, West Indies			3		3
San Antonio Light (15 miles east of), Cuba				2	2
San Filipe Keys (one of), Cuba				1	1
San Geronimo Island, Lower California				1	1
San José de Guatemala		1			1
San Quentin Harbor, Lower California				1	1
San Salvador, West Indies				1	1
Sanger Island, Hoogly River, British India			1		1
Saona Island, West Indies (north side of)			1		1
Scarborough Shoals, China Sea	1				1
Seal Shoal, Newfoundland			1		1
Serranilla Bank, Caribbean Sea			1		1
Seven Stones, off Land's End, England				1	1
Shark's Point, mouth of Congo River			1		1
Sheep Keys Shoals, Bahamas			1		1
Shoal Bay (7 miles south of Petty Harbor), Newfoundland				1	1
Sicily Island, near Avola	1				1
Smith's Island, Port Hood Harbor, Cape Breton				2	2
Soldier's Ledge, Tusket Island, Nova Scotia	1				1
Soledad Lagoon, Lower California				1	1
South Bimini Shoals, Bahamas	1	1			2
Stackpole, England	1	1			2
Straits of Magellan, South America		1			1
Sumatra, Gasper Straits			1		1
Suwarrow Reef, South Pacific			1		1
Swallow Reef, China Sea				1	1
Talbot's Passage, Cape Horn		1			1
Taylor's Bank, river Mersey, England		1			1
Terschelling Light, Netherlands			1		1
Tonala Bar, Mexico	1	1		1	3
Tongue Island, English Channel		1			1
Torkeo (near), Sweden		1			1
Trial Island, British Columbia		1			1
Trinidad, West Indies				1	1
Turk's Island, Great Sand Cay		1			1
Turk's Island, Middle Reef, Bahamas	1				1
Turk's Island, Northwest Reef, Bahamas	1				1
Tuspan River (mouth of), Mexico	1				1
Tuspan Bar, Mexico		1		1	2
Valdes Peninsula, Patagonia	1				1
Verdon Roads (near Bordeaux), France		1			1
Victoria Harbor, British Columbia			1		1
Walney Island, England				1	1
Watling's Isle (130 miles north of), Bahamas				1	1
Wicklow Bay, Ireland			1		1
Wood's Island, Bay of Islands, British America	1				1
Woody Island, Cape Breton, British America	1				1
Yabucoa, Porto Rico			1		1
Yarmouth, Nova Scotia		1	1		2
Zanzibar, Africa			1		1

REPORT

ON

LIFE-SAVING ORDNANCE.

TABLE 66.—*List of places where American vessels have stranded* IN FOREIGN WATERS, *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Bermuda		2	2		4
Black Point and Seven Hills, Honduras, Central America	1				1
Boiling Reef, Gulf of Georgia	1				1
Bolton Island, Molucca Group, East Indies	1				1
Bonacca Harbor, Honduras, Central America	1				1
Brara Island, Cape de Verde Island		1			1
Brazil (latitude 5° 2′ south, longitude 35° 22′ west)				1	1
Brier Island, Northwest Ledge, Canada		1			1
Brier Island, Pond Cove, Nova Scotia		1			1
Buckos Reef, Tobago, British West Indies	1				1
Caicos Island, West Indies				1	1
Caicos Reef (north of), Bahamas		1	1		2
Cape Agulhas (15 miles north of), Africa			1		1
Cape Bollard, Newfoundland				1	1
Cape Breton Island		2		1	3
Cape Frio (60 miles from Rio)				1	1
Cape Hogan, Arichat Island, Nova Scotia		1			1
Cape Horn				1	1
Cape Isabella, San Domingo			1		1
Cape Negro (25 miles east of Rio Janeiro)		1			1
Cape Negro Island, Nova Scotia	1		1		2
Cape Sable, Nova Scotia	1				1
Cape Saint Mary, Newfoundland			1		1
Cape Saint Mary, Newfoundland (5 miles south of)				1	1
Cape Verde Island		2			2
Cardenas, Cuba			3		3
Cariaco, Gulf of Venezuela			1		1
Caribbean, near reef, Cuba		1			1
Carimata Straits, East Indies	1				1
Carlisle Bay, Barbadoes		1			1
Carnavon Bar, North Wales (near Llanenddwyn Point)				1	1
Cay Bars, Little Bahamas			1		1
Cay Largo, West Indies			1		1
Cette (near), France				1	1
Charlottetown Harbor, Prince Edward Island				1	1
Cheticamp, Cape Breton			1		1
Chickotan Island, Kurile Islands, Asia			1		1
China Sea			2	1	3
Chincorro Reef (90 miles north of Belize)		1			1
Cienfuegos Harbor (west head of), Cuba		1	1		2
Coatzacoalcos River (on Sand bar), Mexico		1			1
Cockburn Harbor Shoal, E. C		1			1
Colonia Harbor Rock, South America	1				1
Colorado Reef, Cuba	1		2		3
Colorado Reef, Lord Howe's Island, Australia			1		1
Comacho Bay, Peru			1		1
Constantinople (near), Turkey		1			1
Coral Island, Japan Bay				1	1
Corn Island, Central America	1				1
Coxyde, Belgium				1	1
Crooked Island, Bahamas	1				1
Crooked Island and Passage, near Castle Islands, West Indies		1			1
Dartmouth, England			1		1
Demas Key (Salt Key Banks), West Indies		1			1
Dona Maria Inlet, Cuba	1				1
Dugeon Shoal, Yorkshire, England		1			1
East London, Africa			1		1
Emulous Ledges, Nova Scotia				1	1
English Bank (probably), Bristol Channel	1				1
Ensenada, mouth of, Bristol Channel, Argentine Republic			1		1
Fiji Islands, northeast group			1		1
Flores Islands		1			1
Flushing, mouth of West Scheldt, Holland				1	1
Formentera, Balearic Islands		1			1
Frenchman's Harbor, south side Isle of Ruatan		1			1
Garrucha Roadstead, Spain				1	1
Gibraltar		1			1
Giegler Light, near		1			1
Gonaives Island, West Indies			1		1
Goodwin Sands, England			1		1
Grand Bahama	1		2		3
Grand Cayman, West Indies				1	1
Grand Sands, near Trieste			1		1
Grand Turk, northeast of reef		1			1

TABLE 63.—*List of laces where American vessels have stranded* IN FOREIGN WATERS, *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Greytown, Nicaragua	.....	.....	.....	1	1
Grindstone Island, New Brunswick	1	.....	.....	.....	1
Guanabana (10 miles north of Matanzas), Cuba	.....	.....	.....	1	1
Gull Island, Long Harbor, Newfoundland	.....	.....	1	.....	1
Gull Island, Nova Scotia	1	.....	.....	.....	1
Hake, South Banks, Nieuwe Diep	.....	.....	.....	1	1
Halifax, Nova Scotia	.....	.....	1	.....	1
Hammond's Knoll (off Yarmouth Head)	.....	1	.....	.....	1
Harbor Island, Bay of Islands, Newfoundland	.....	.....	1	.....	1
Havana and Matanzas (between), Cuba	.....	1	.....	.....	1
Hayo Main Rock, Bay of Yeddo, Japan	.....	1	.....	.....	1
Hesquot Sound, Vancouver's Island	1	.....	.....	.....	1
Hogsty's Reef, Bahamas	.....	.....	1	.....	1
Honduras (near Truxillo), Central America	.....	.....	.....	1	1
Hong-Kong, China	2	.....	.....	.....	2
Hoogly River, Diamond Harbor, British India	1	.....	.....	.....	1
Hudson Bay	.....	.....	1	.....	1
Indian Island, Labrador	.....	1	.....	.....	1
Jacquemel Bay, Hayti	.....	1	.....	.....	1
Jardinillos Reef, West Indies	.....	1	1	.....	2
Jarvis Island, South Pacific	.....	.....	.....	1	1
Jeremie Harbor, West Indies	.....	.....	1	.....	1
Jig Rock, near Shelburne, Nova Scotia	.....	.....	1	.....	1
Kaloot Bank, Holland	.....	1	.....	.....	1
Kamschatka, Sea of Okhotsk	.....	.....	1	.....	1
Lavendera Shoal, Matanzas Harbor	.....	1	.....	.....	1
Lemoig, Jutland	.....	.....	1	.....	1
Leones Islands, Montego Gulf, Jamaica	1	.....	.....	.....	1
Liberty Point, Campobello Island, New Brunswick	1	.....	.....	.....	1
Liscomb Harbor, Nova Scotia	.....	.....	.....	1	1
Little Curaçoa, Caribbean Sea	.....	.....	.....	1	1
Liverpool, England	.....	.....	1	.....	1
Lockport Harbor, Nova Scotia (ledge off)	.....	.....	.....	1	1
Lockville, Geography Bay, West Australia	1	.....	.....	.....	1
Los Palmos, Canary Islands	.....	.....	1	.....	1
Macassar Straits, East Indies	1	.....	.....	.....	1
MacNutt's Island, Nova Scotia	.....	1	.....	.....	1
Madison Island	.....	1	.....	.....	1
Madeira Island	.....	1	.....	.....	1
Magdalen Island, Gulf of St. Lawrence	.....	1	.....	.....	1
Malpec Bar, Gulf of St. Lawrence	1	.....	.....	.....	1
Mainadieu Reef, Cape Breton	.....	.....	1	.....	1
Maquabo, Porto Rico	.....	.....	1	.....	1
Marfa Drychon Beach, Cardigan Bay, Wales	1	.....	.....	.....	1
Mariguana Island, West Indies	.....	1	.....	.....	1
Mariguana Reef, Bahamas	1	.....	.....	.....	1
Matane (2 miles west of), St. Lawrence River	.....	.....	.....	1	1
Matanilla Reef, Bahama Banks	.....	.....	1	.....	1
Matanzas Harbor, Cuba	.....	.....	1	.....	1
Mayo Island, Cape Verde Group	1	.....	.....	.....	1
Mazatlan, Mexico	.....	.....	.....	1	1
Mexico (coast of)	.....	.....	1	.....	1
Middle Wolf, New Brunswick (southern point of)	.....	.....	1	.....	1
Mistaken Point, Newfoundland	.....	.....	1	.....	1
Monte Rugginore (east of Sardinia)	.....	1	.....	.....	1
Morant Cays, West Indies	.....	.....	.....	1	1
Moselle Shoals, Bahamas	1	.....	.....	.....	1
Murder Island Ledge (near Yarmouth), Nova Scotia	.....	.....	1	.....	1
Musquash, Bay of Fundy, New Brunswick	.....	.....	1	.....	1
Nag's Head, Louisburg, Cape Breton	.....	1	1	.....	2
Neiva, St. Domingo, and Navassa (between)	.....	.....	.....	1	1
Neptune Shoal, Batavia Harbor	.....	.....	1	.....	1
Nevis, Windward Islands	.....	.....	.....	1	1
New Harbor Point, Nova Scotia	.....	.....	.....	1	1
Newport Roads, Wales	.....	1	.....	.....	1
Noel's Point Reef (entrance St. George's Harbor)	.....	1	.....	.....	1
No Name Cay, near Abaco, West Indies	.....	.....	.....	1	1
North Bimini, Bahamas	.....	.....	1	.....	1
Nuevitas Harbor, Cuba	.....	1	.....	1	2
Pabillon de Pica, South America	.....	.....	1	.....	1
Palance Shoals (near Manila)	.....	1	.....	.....	1
Para River (mouth of), South America	1	.....	.....	.....	1
Point Castilla, Honduras, Central America	.....	.....	.....	1	1
Point Negro and Point Race (between), South America	.....	.....	1	.....	1

TABLE 65.—*List of places where American vessels have stranded* IN FOREIGN WATERS *&c.*—Continued.

Name of place.	Fiscal year ending June 30, 1875.	Fiscal year ending June 30, 1876.	Fiscal year ending June 30, 1877.	Fiscal year ending June 30, 1878.	Total.
Ponce, Porto Rico and St. Thomas (between)				1	1
Popa Island, Pacific Ocean (Malay Archipelago)			1		1
Porter's Passage (east side of), Halifax, Nova Scotia			1		1
Port Maria, Jamaica	1				1
Porto Rico, West Indies			1		1
Progresso, Mexicoo		1			1
Prospect, Nova Scotia		1			1
Quoin Point, Cape Good Hope, Africa		1			1
Quronata, coast of, Spanish Honduras				1	1
Rocas Reef (125 miles northwest of Cape Saint Roque), Brazil	1				1
Rocky Reef, Point Carlisle Bay, Jamaica				1	1
Rum Cay, Bahamas		2			2
Sable Island, Nova Scotia		2			2
Saint George, New Brunswick	1				1
Saint John's, Porto Rico			1		1
Saint Lawrence Bay				1	1
Saint Mary's Bay, Nova Scotia	1				1
Saint Pierre, Newfoundland			1		1
Saint Thomas Harbor, West Indies			3		3
San Antonio Light (15 miles east of), Cuba				2	2
San Filipe Keys (one of), Cuba				1	1
San Geronimo Island, Lower California				1	1
San José de Guatemala		1			1
San Quentin Harbor, Lower California				1	1
San Salvador, West Indies				1	1
Sanger Island, Hoogly River, British India			1		1
Saona Island, West Indies (north side of)			1		1
Scarborough Shoals, China Sea	1				1
Seal Shoal, Newfoundland			1		1
Serranilla Bank, Caribbean Sea			1		1
Seven Stones, off Land's End, England				1	1
Shark's Point, mouth of Congo River			1		1
Sheep Keys Shoals, Bahamas			1		1
Shoal Bay (7 miles south of Petty Harbor), Newfoundland				1	1
Sicily Island, near Avola	1				1
Smith's Island, Port Hood Harbor, Cape Breton				2	2
Soldier's Ledge, Tusket Island, Nova Scotia	1				1
Soledad Lagoon, Lower California				1	1
South Bimini Shoals, Bahamas	1	1			2
Stackpole, England	1	1			2
Straits of Magellan, South America		1			1
Sumatra, Gasper Straits			1		1
Suwarrow Reef, South Pacific			1		1
Swallow Reef, China Sea				1	1
Talbot's Passage, Cape Horn		1			1
Taylor's Bank, river Mersey, England		1			1
Terschelling Light, Netherlands			1		1
Tonala Bar, Mexico	1	1		1	3
Tongue Island, English Channel		1			1
Torkeo (near), Sweden		1			1
Trial Island, British Columbia		1			1
Trinidad, West Indies				1	1
Turk's Island, Great Sand Cay		1			1
Turk's Island, Middle Reef, Bahamas	1				1
Turk's Island, Northwest Reef, Bahamas	1				1
Tuspan River (mouth of), Mexico	1				1
Tuspan Bar, Mexico		1		1	2
Valdes Peninsula, Patagonia	1				1
Verdon Roads (near Bordeaux), France		1			1
Victoria Harbor, British Columbia			1		1
Walney Island, England				1	1
Watling's Isle (130 miles north of), Bahamas				1	1
Wicklow Bay, Ireland			1		1
Wood's Island, Bay of Islands, British America	1				1
Woody Island, Cape Breton, British America	1				1
Yabucoa, Porto Rico			1		1
Yarmouth, Nova Scotia		1	1		2
Zanzibar, Africa			1		1

REPORT

ON

LIFE-SAVING ORDNANCE.

ORDNANCE OFFICE, WAR DEPARTMENT,
Washington, November 8, 1878.

SIR: I have the honor to inclose herewith a copy of the report on life-saving apparatus made by First Lieut. D. A. Lyle, Ordnance Department U. S. A., and embodied in my annual report to the Secretary of War for the present year.

Respectfully, your obedient servant,

S. V. BENÉT,
Brigadier-General, Chief of Ordnance.

S. I. KIMBALL, Esq.,
General Superintendent Life-Saving Service,
Washington, D. C.

REPORT

ON

LIFE-SAVING APPARATUS: GUNS, PROJECTILES, ETC.

BY LIEUT. D. A. LYLE, ORDNANCE DEPARTMENT U. S. A.

[Fifty-four plates.]

NATIONAL ARMORY, SPRINGFIELD, MASS.,
August 16, 1878.

SIR: I have the honor to submit herewith my report upon life-saving apparatus.

Fifty-four plates accompany the report.

Very respectfully, your most obedient servant,

D. A. LYLE,
First Lieut. Ord. Dept. U. S. Army.

The CHIEF OF ORDNANCE, U. S. A.
(Through the commanding officer, National Armory.)

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D. A. LYLE,
Lieutenant of Ordnance.

NATIONAL ARMORY, *August* 15, 1878.

INTRODUCTION.

In the early part of the year 1875 the honorable Secretary of the Treasury applied to the Secretary of War for assistance in the prosecution of experiments for the purpose of improving the life-saving apparatus used by the Treasury Department, which at that time were under the special charge of Capt. J. H. Merryman, United States Revenue Marine, and requested that an officer or officers of the Ordnance Department be designated to assist Captain Merryman "in these important matters."

On the recommendation of the Chief of Ordnance, the Secretary of War directed that the "Board on Experimental Guns," convened by Special Order No. 221, Adjutant-General's Office, October 10, 1874, of which Major Crispin, Ordnance Department, was president, be charged with the prosecution of these experiments, in connection with Capt. J. H. Merryman, United States Revenue Marine. This action was taken April 12–16, 1875, and Sandy Hook, N. J., was selected as the most favorable locality for these experiments.

The important and multifarious duties with which the Ordnance Board—formerly "Board of Experimental Guns"—was specially charged were so great as not to admit of any one of its members devoting the time necessary for a thorough investigation and discussion of the subject. In view of this fact Captain Merryman recommended, on May 21, 1877, "that an application be made to the Chief of Ordnance for the detail of an officer for this special service." Colonel Crispin, president of the "Ordnance Board," concurred in this recommendation in his indorsement of June 1, 1877, upon Captain Merryman's letter, and further recommended that said officer should place himself in communication with Captain Merryman and the Ordnance Board, "for such suggestions and instructions as may be deemed proper to give him." These recommendations were approved by the Chief of Ordnance June 6, 1877, and Lieut. D. A. Lyle, Ordnance Department, was "specially assigned to this duty in addition to his regular duties" at the National Armory, Springfield, Mass. This officer entered upon the duty at once, and the results of his labors are embodied in this report.

No claims of great originality are made, as this apparatus, like the Parrott patent, is a direct evolution from the system of Captain Manby, which dates back to the beginning of the present century. The advances which have been made during the past year are the result of careful study and conscientious experiment. The data recorded are of value for future reference. The writer appreciates the fact that many improvements are yet to be made in life-saving apparatus, and entertains the hope that his humble efforts may serve as a basis upon which to found future experiments.

PART I.

REPORT.

CHAPTER I.

I. RIFLE PROJECTILES.

The first experiments were made with rifle projectiles fired from a 3-inch muzzle-loading rifled mortar. This method did not prove satisfactory for the following reasons:

I. On account of the lack of simplicity in loading. The detailed operations of loading are given below.

1. Inserting cartridge and ramming home.
2. Inserting junk-wad or sabot.
3. Unscrewing cap on front end of projectile.
4. Removing cap.
5. Inserting line in axial cavity and drawing it through shot.
6. Putting on rubber washer or washers.
7. Putting on metal washer.
8. Tying knot in end of line.
9. Inserting washers and knot in the cavity in the front end of shot and drawing the line taut.
10. Returning the cap to its position.
11. Putting in the retaining screw to hold the cap.
12. Adjusting line in radial slot in base and in longitudinal groove.
13. Twisting the fine wire which passes around the head of the cap about the line to hold it in the prolongation of the axis of the bore and prevent its being cut off by abrasion in passing out of the piece.
14. Inserting projectile in the bore and ramming it home.

II. The liability of the heated gas from the charge to enter the axial cavity and either burn off the line or blow off the cap. The loss of the cap permits the knot and washers to escape, and when the strain comes upon the line it is very likely to be cut by the edges of the axial cavity in front, as is exemplified in Fig. 13, Plate XXIX.

III. The failure of wire ropes (either copper or iron) to sustain the shock of discharge. These ropes or cords are interposed between the shot and line for the purpose of avoiding the action of the flame upon the line. These rigid materials generally broke before the line.

IV. The necessity for the employment of wads and sabots.

V. The diminution of range due to resistance of the air to the passage of the line. This increased resistance of the air was developed by the spiro-conical form assumed by the line in the trajectory, due to the rotation of the rifle projectile.

VI. The twisting of the line due to the rotation of the projectile.

It was judged, from the indications left upon the wooden sabots which were recovered (see Figs. 11, 12, Plate XXIX) after firing, that if a soft-metal sabot had been used the force of discharge would have wedged it in the radial slot of the base and have caused it to cut the line as it was suddenly swung to the rear by the strain, unless a very thick sabot were used. Paper wads were found to be better than wooden sabots.

VII. The greater expense and difficulty attending the manufacture of both guns and projectiles.

After losing the caps belonging to the rifled projectiles, they were fired a few times by inserting them point first into the rifled mortar. The shot reversed after leaving the gun, and retained their axial rotation, though their flight was unsteady.

Solid, smooth-bore projectiles were next tried in the rifled mortar and gave better results. The escape of gas through the grooves was very great, in some instances burning off the line. One shank was broken off in firing, which was due, not to the form of the shank, but to the material, it having been made of high steel instead of wrought iron. No particular difficulty seemed to be experienced in firing smooth-bore projectiles from rifled guns, provided the shanks were long enough to protect the line from the gases which escape through the grooves.

Enough was learned from these experiments to warrant the conclusion that smooth-bore guns and projectiles were better adapted for this purpose than the rifled ones as here applied; and that spiral springs, wire cords, and rubber washers were either useless or annoying, and always more or less impracticable.

II. SMOOTH-BORE GUNS AND PROJECTILES.

After the difficulties first experienced it was determined to cut loose from rifled mortars, rifle projectiles, wire ropes, spiral springs, rubber straps, rubber washers and plugs, brass washers, caps and retaining screws, and seek for a solution of the problem in some system which would combine great simplicity with efficiency, and which would lessen the cost of manufacture and furnish a method whose details would not be so complicated as to be beyond the comprehension of those required to put it in practice.

1. SMOOTH-BORE GUNS.

The second attempt was made with smooth-bore guns. Bronze was selected as the material from which to make the experimental guns, for the following reasons: On account of its great ultimate tenacity, its ductility, its combination of great strength with light weight, its freedom from destructive corrosion when exposed to the moisture of sea-coast stations, its non-liability to sudden rupture, its availability for recasting, and its value as old bronze after condemnation. Guns made from this material are easily kept in order, as the bores do not rust, a fact of considerable importance with small calibers, on account of the difficulty of cleaning the bore. They are not liable to burst explosively, by reason of their ductility, and when worn out they may be sold for a fair price as old bronze. The only external injury to which they are liable is the bending of the trunnions.

The internal injuries resulting from the powder, such as enlargement at the seat of the charge, and cavities produced by the melting away of the metal by the heat developed by the explosion of the charge, are not serious. The erosive action of the gases is not great, because of the almost entire absence of windage. The wear of the vent is obviated by the use of copper vent pieces. Lodgments and enlargements are not produced in these guns, since projectiles nearly the length of the bore are used and therefore there is no balloting. The bore may be scratched by projectiles and sand, but that is not a serious injury. The softness of the metal, and its proneness to deterioration under rapid firing which

causes heating, though grave objections to the use of bronze for field-pieces, do not affect its use for this service, where rapid firing is never resorted to, consequently there is little danger of heating or of melting the metal of the bore. Small charges of powder are generally used, therefore little is to be apprehended from excessive erosion.

2. PROJECTILES.

Full descriptions of these are given in a subsequent part of this report. These projectiles are modifications of Captain Manby's shot. The caliber and weight have been reduced. The lengthening of the bore, the suppression of a greater part of the windage, and the employment of improved lines, have increased the *effective* force of the powder, diminished the resistance which the projectile and line experience from the air, and have extended the range. It will be seen that the weights were increased as the experiments proceeded; this resulted in decreasing the initial velocity and the consequent violence of the vibrations of the line when the charge of powder remained constant. These projectiles are carefully turned and finished to fit the bore of the gun accurately. The careful method of finishing renders them more expensive, but even then they are cheap. Few of them are required, and the resulting efficiency counterbalances the extra cost. As in the Parrott gun, the bore of the gun must be kept clean and the projectiles free from rust.

The gun being of bronze, no difficulty is encountered in keeping the bore clean. The few projectiles at each station are easily kept free from rust by the men. Experimental projectiles Nos. 15, 16, and 17 are the ones recommended for use with 2″, 2″.5, and 3″ guns respectively. The 2″ projectile will be the most expensive, as it has to be bored out and filled with lead to increase its weight. But even its cost is trifling as compared with rockets and some patented projectiles. Lead projectiles similar to experimental projectile No. 13 are found to upset more or less, to lead the bore, and to strain the gun greatly. Wrought-iron projectiles scratch the surface of the bore badly.

3. SHANKS.

These were found to be of great importance. By prolonging them near to or beyond the muzzle of the gun when it is loaded, they keep the line from being cut off by the passage of the projectile, and do away with the necessity for a line-supporter. Several kinds of shanks were used. It was found that with very short shanks, the line would be burned off where tied in the eye. It was suspected that this arose partly from the shortness of the shank and partly from the shape of the base. The gases which pass over and around the shot at the first instant of expansion would follow the incline of the frustum and converge at and near the apex of the cone produced. The apex was near the eye-hole of the short shanks. Then a longer shank was tried, and that portion of its length between the base of the shot and eye-hole polished brightly, in order to ascertain, if possible, whether the gas converged at any point upon the shank; and, if so, where. The result confirmed the hypothesis, and a very dark stain showed the maximum convergence of the gas to be about the apex of the cone, whose frustum formed the base, or, perhaps, a little in front of it. Long shanks were afterwards used, and with great success. The earlier shanks were made of whatever scrap could be obtained for the sake of economy. At first the thread ex-

tended an inch and a half into the shot, but the junction of the thread and body was found to be a point of weakness, which should have been anticipated, especially as it came directly at the base of the shot, where the greatest strain was thrown on the shank when the projectile reversed. They were found to bend and crack at this point. The next step was to shorten the length of the screw-thread and let the body of the shank extend a short distance into the shot. This was an improvement, but continued practice upon hard earth showed that the shank could be bent and was still weak. A shank forged from wrought iron, with the dimensions increased, was then made and adopted. It may be seen in experimental projectiles Nos. 15, 16, and 17. A few very long shanks were tried and behaved very well. The shanks should always be of the best wrought iron, and should be carefully forged and finished. A steel shank, that was made by mistake, broke off in firing, showing that material to be too brittle for this purpose.

III. GUN-CARRIAGES.

The gun-carriages are made with wooden cheeks, bound with iron. They combine elasticity with strength, and act well upon sandy beaches. The wrought-iron handles increase the ease with which they may be carried. If necessary the gun may be dismounted, and carried by one man upon his shoulder, while another takes the carriage. Two projectiles may be placed upon the rear transom and the whole carried easily by four men. The small gun and carriage are intended to be carried by two men; here, as before, the projectiles may be placed upon the rear transom. The load may be balanced by sliding the hands along the handles. The addition of iron cheek-straps increases greatly the durability of the carriages. The carriages for guns C and B are the ones recommended for adoption. The vent pieces of the guns project high enough to avoid difficulty in the use of friction primers at ordinary angles of elevation. Gun B and carriage are too light to be used with ordinary friction primers without some danger of disturbing the pointing of the piece, as the primers pull off too hard.

IV. SPONGE AND RAMMER.

A single staff, with a rammer head on one end and a sponge on the other, constitutes this implement.

V. WIPING-RODS.

These were made from old condemned musket ramrods of obsolete pattern. One end is curved to form an eye, and a cork-screw wiper is screwed on the other end. This is useful for withdrawing cartridges when necessary, and, with flannel or cotton waste wrapped around the wiper, is valuable for cleaning the bore of the gun. It also may be used as a rammer for pressing home the cartridge, by reversing it and inserting the eye-end in the bore.

VI. PRIMING-WIRES.

Two of these are issued with each gun, as one may be lost. They are made of steel or brass wire, preferably of the former.

VII. GUNNER'S HAVERSACK.

One of these should be issued with each piece, to be carried by the keeper of the station. The cartridges, friction primers, priming-wires, lanyard, combination-level, and a piece of flannel for use with the wipers are carried in this pouch.

VIII. POWDER.

No particular kind of powder has ever been adopted for use at the life-saving stations. "Pebble" powder was deemed too large grained, and "rifle" powder too fine grained for this service. Four different specimens of powder were procured from the Hazard Powder Company.

The tests for initial velocity, which will be given upon subsequent pages, show that Navy cannon powder gives a good initial velocity for a not excessive strain or pressure. That test, however, was not a fair one for this powder, which, on account of its large grain, was more or less broken and compressed in loading the metallic shells. It is probable that both the velocity and pressure are too great as given. The uniform action of this powder during the experiments was such as to commend it to very favorable notice. Musket, rifle, and duck-shooting powders are all more or less quick and violent in their action. The musket (Hazard) is very uniform, but quite too rapid in its inflammation. A direct comparison of these powders was made, with the results given below.

Comparisons of different kinds of powder.

[Maker: Hazard Powder Company. Gun: 2".5 bronze gun C. Charge of powder: 3 ounces in every case; carefully weighed. Projectile: Experimental No. 16, marked "L. 12." Weight of projectile: 18.75 pounds. Shot-line: Linen No. 7 (Silver Lake); same line as used in first series of experiments. Faking-box: Box A. Place: Sandy Hook, N. J. Date: May 6, 7, and 8, 1878. The same projectile, line, and faking-box were used throughout the comparison.]

No. of round.		Kinds of powder.			
		Navy cannon.	Mortar.	United States musket.	Sea-shooting duck.
		Yards.	*Yards.*	*Yards*	*Yards.*
1	Ranges in yards	281⅔	284	292⅔	308⅓
2	......do	280	267⅔	284	293⅓
3	......do	266⅔	263⅓	289	300
4	......do	281⅔	269	280⅓	272
5	......do	280⅔	261	263	286⅓
	Total	1,390⅔	1,345	1,409	1,460
	Arithmetical mean	278.13	269	281.8	292
	Greatest variation from mean	11.47	15	18.8	20
	Least variation from mean	1.87	....	1.47	1.33
	Mean variation	4.58	6	8.1	10.2

From the above table it will be seen that the Navy cannon powder acted very uniformly, four of the five shots being almost identical. The "sea-shooting duck" is represented as giving the best mean range; this is explained by the difference in the velocities of the wind. The wind was light when the "duck" powder was used.

The Navy cannon is much coarser grained than the musket or rifle powder, but is not so coarse but that most, if not all, of it is consumed before the projectile leaves the piece. Army cannon is too coarse

grained; a portion of the charge is lost by being blown from the gun before completely consumed. Selecting from the samples tested, the preference should be given to the Hazard Navy cannon. The effect of a powder depends more upon the manner of loading than has been supposed by those who are not accustomed to dealing with it. A charge of Navy cannon can, by two or three forcible jams of the projectile when inserted in the bore, be so compressed and the grains so broken, as to exhibit all the violence of a fine-grained powder. Powder stored along the coast is exposed more or less to the moisture of the sea-air and deteriorates very rapidly. Since only small quantities are kept at the life-saving stations, the powder should be renewed annually and the stock on hand used for drilling and exercising with the apparatus.

IX. SHOT-LINES.

On a comparison of the tables of the breaking weights of the different shot-lines, it will be seen that in every instance except two, the linen lines are stronger than the hemp. It will also be noted that the linen lines have more stretch per linear foot than the hemp lines. The tables, &c., may be found upon subsequent pages. The braided linen lines have proved superior in usefulness to the hemp. The preference should be given to unbleached linen thread for the manufacture of shot-lines. Great care should be taken that none but the best thread be put in such lines, and that in braiding a continuous line, when the spools are changed, they should not all be changed at the same moment, else a weak spot is the result. Bleaching of any kind is harmful. Hemp is too brittle and becomes very harsh after a few shots. The water-proof lines pass through the air with less friction than those having the ordinary finish and generally attain a better range. The vibrations of the line due to faking is the greatest danger to which it is subjected. These vibrations reach their maximum amplitude in the first part of the trajectory, when the velocity of the shot is greatest. A place varying from 20 to 40 yards from the shot seems to be the critical point. In that vicinity the line generally breaks. It is a case quite similar to that of snapping a whip and breaking off the farther portion of the lash. There is little doubt but that long storage of lines will destroy their good qualities. Lines after being stored for a year or two should be used for pratice drills. New lines when first received are stiff and refractory; this makes them difficult to fake. They should be wound from the original coil upon a reel, to avoid twisting, and should be fired once or twice with light charges of three or four ounces of powder. This usage will make them a little more flexible, so that they can be faked with less trouble. New lines, if possible, should be used when firing over wrecks. There should always be more than one good line at the station, for a line once wet becomes difficult to handle. New lines have not had the stretch taken out of them by firing, and consequently are not apt to be broken should it be necessary to fire with heavy charges.

X. FAKING-BOXES.

These are boxes, peculiarly constructed, to contain the shot-lines and preserve them in readiness for firing at a moment's notice. Their size varies with the diameter and length of line to be stored for service. It has been found that the less the boxes in length and width, the better they were adapted to prevent the rupture of the shot-line, in consequence

of the necessary shortening of the fakes in the line. Experiment showed that short fakes or loops of line diminished very markedly the length or amplitude of the vibrations in the line when running out of the box. In the case of long fakes, the line would break at the bend, or change of direction of the line, before its inertia was overcome. The effect was the same as if the line had been nailed fast at the ends of the fakes. This was especially noticeable in the case of hemp lines, whose fibers are very brittle, though very strong. In the effort to diminish the lengths of the fakes, experiments were made with boxes of lesser length and width than those used in service at present. This required the faking-pins to be longer. This alteration demanded a much deeper faking-box and one that had to have some method devised to hold it at the proper inclination when about to fire. This form of box failed for the following reasons, namely: the faking-pins were so long that they bent toward each other unduly in the process of faking, rendering it somewhat difficult to disengage the line from them at the critical moment, and bringing such a strain upon the frame that it was liable to split. To remedy these defects, the frames and faking-pins would have to be made heavier and longer, which would add to the weight of the box; a result not desired. Increasing the depth of the box weakened it and made it more liable to be broken by the successive impacts of the vibrating fakes, which are always severe. It was found advisable to keep the height of the pins the same as at present and to make the boxes of a size just capable of holding the shot-lines, provided that in no instance should the boxes be longer than three feet. Four sizes of boxes were used, marked, respectively, A, B, C, and D. Boxes A and B are the sizes now used in the service; C and D were designed and used with lines No. 5 and No. 3½, respectively. It was found that the life of a wooden faking-box, when heavy charges of powder are used, is short. The vibrations of the line, especially the lateral ones, which originate in the change of the line from tier to tier of fakes, are powerful enough to split the ends of the box and to start the dovetailing after a few shots. In fact, the ends of the box are sometimes split at the first fire. The split usually occurs about four inches from top of the box. The natural vibrations of the line, due to its position in the tiers of fakes, would be in diagonal planes nearly at right angles to each other; this gives rise to a resultant vibration, whose plane is variable, depending on several changing circumstances. When this resultant plane happens to assume a position perpendicular to the bottom and longer axis of the faking-box, either the bottom or the uppermost side of the box, and sometimes both, are liable to be split. The plane of resultant vibration is so unstable in position, that this does not often occur; the ends are much more apt to be split. It was found that the interior edges of the box acted as knife edges, cutting the rapidly paying-out lines, and this, too, when the boxes are made of soft pine and the edges are angles of 90°. The velocity of the passage of the line, together with the striking due to the vibrations, compensated for the unfavorable nature and material of the knife edge. The edges were rounded, and no further difficulty was experienced from that cause. Sometimes the entire line was carried out, the end being taken in some instances more than 100 feet in front of the box. Should this occur in service, the shore end might be carried out into the water and be beyond the reach of the surfmen, though perfectly sucessful in all other particulars. To prevent this, a small notch, about the size of the diameter of the shot-line, is cut in the side of the box, and all its edges and corners carefully rounded and smoothed. Similar notches (which need not be rounded) are cut in each side of the "false" bottom. Then, after faking the line,

the operator leads the end in his hand down one side of the tiers of fakes to either of the notches in the "false" bottom, and the assistant puts the faking-box over the rope and pins, with the notch in the box on the side where the line is led out; this allows the box and frame to be fastened together without trouble, and leaves the shore-end of the line hanging from the box. In firing, the *notched* side of the faking-box is placed *uppermost* and the protruding end made fast to another line on shore, to obviate the danger of its loss by being hauled out to sea. In the service boxes, the frames and boxes are held together by two staples and a hook. The latter was always coming out, exposing the frame and line to the chances of falling and becoming entangled in transportation. Hasps and turn-buttons were tried on the experimental boxes; these, though safe, sometimes gave trouble in getting ready for firing when in great haste, and, the button being on the box, it was thought to give an opportunity for the line, when vibrating or whipping, to catch and be cut off. Hasps, staples, and lever snap-hooks are now recommended for trial. The boxes now made have the corners strengthened for about five inches with yellow-metal (an alloy of tin and copper) angle-pieces at each corner, near the bottom—*top* when in position for firing.

XI. EXTENT OF RANGE OF SHOT-LINE.

In most all of the accounts of trials and experiments with line-carrying apparatus, the subject of *range* seems to be the only one considered.

If the attention of inventors is called to the fact that *accuracy* also is in some degree required, they immediately wander from the point, and bring up the fact of the slight deviation of their projectiles from the plane of fire as conclusive evidence that their method is perfect.

The minimum lateral deviation or *accuracy* with which a line can be extended a given distance is a matter of vastly more importance than apparently has ever been accorded by experimenters. The deviation of the projectile is seldom excessive, while the bowing or *drift* of the line may be out of all proportion.

What advantage accrues if a range of a mile be obtained when at every shot the line falls clear of the vessel by perhaps many yards, due to the lateral drift of the line from the effect of the wind? The *drift* or lateral deviation of the shot-line from the plane of fire increases with the lightness of the line, the increase in the angle of elevation of the gun, and the diminution of axial tension upon the line; and, lastly, it depends greatly upon the horizontal angle that the directions of transverse winds make with the plane of fire. The effect of the wind is greatest when this angle is 90° or blowing directly across the plane of fire. With light lines, longer ranges but less accuracy are obtained. The greatest range on record for a mortar and line-carrying projectile was obtained with gun A and a Silver Lake braided linen line No. 3½. This range was 694⅔ yards, measured distance.

The greatest range heretofore obtained with a mortar was 631 yards, reported by Captain Ottinger. How accurately this range was measured, or whether the distance was only estimated, or what size of line was used is unknown to the writer; but that the mortar was very much heavier than the one used in the case above cited is beyond doubt.

A range of 400 yards is understood to be about the maximum range necessary for the requirements of the service along our coasts, and it is not probable that a hawser and life-car can be used with success over even so great a distance.

XII. VELOCITY OF THE WIND.

The velocity of the wind given in the tables of fire is not the actual velocity at the instant of firing. The results are the mean velocities of the wind during the intervals between the shots. This interval varies generally from 10 minutes to 40 minutes. The method of obtaining the velocities is as follows: A reading of the anemometer was taken a few minutes before the first shot upon any given day, together with the time of observation; the second reading was taken directly after the first shot; the third reading was taken directly after the second shot, and similarly for the subsequent shots. From these times and readings the mean velocity of the wind during the intervals was computed.

It was found by observation that the velocity of the wind was constantly changing and came in variable puffs; that it would freshen up for a moment or two and then die away more or less. The intervals between the observations would often comprise several of these alternate maximum and minimum periods. In order that the mean velocity (the one recorded) should always fall *below* the *actual* velocity at the instant of firing, the piece was not fired until the wind freshened and was blowing with its greatest force.

The surface velocity of the wind appeared generally to be less than that above the ground at the summit of the trajectory. This was seen in the effect upon the line, especially when the wind was blowing directly across the plane of fire. The anemometer for surface velocities was always placed opposite the 200-yard stake, except during the last few days of the experiments, when it was situated 50 yards in front and to the right of the firing-point. It would have been placed near the 300-yard stake, but for the fact that the labor, already great, of walking down and back after every shot would have been increased. The writer took all readings himself, and either loaded the piece or was present every time it was loaded and fired during the experiments. This necessitated a great deal of toil through the sand.

During many gales and storms for the past year observations were made as to the frequency in duration of the temporary lulls of the wind.

These were found in the generality of cases to occur often and to last for a varying interval of time, ranging from 7 to 20 seconds. Now, experiments show that line-carrying projectiles rarely occupy more than 8½ seconds in their flight, and that it takes from 5 to 15 seconds more for the line to settle to the ground, depending upon the angle of elevation at which the gun is fired and the weight of the line. Here, then, for extreme cases it may be seen that an interval of about 25 seconds, and in ordinary cases about half that period, is required to fire the piece and to allow the shot to describe its trajectory and the line to settle upon the ground or water. Therefore the piece, in case of wreck, should be prepared for firing, and, with lanyard taut, the gunner should await the favorable lull or moment of least violence in the gale, and then fire the piece without loss of time.

CHAPTER II.

LIFE-SAVING APPARATUS.

RECOMMENDATIONS.

The following guns and projectiles are recommended for the Life-Saving Service:

The caliber of the gun will depend upon the size of line used and the range required.

For ranges of 300 yards and less, with heavy lines (larger than No. 7), a 3-inch gun should be used.

For ranges of 400 yards and less, with service braided lines between Nos. 4 and 7, a 2.5-inch bronze gun should be used.

For ranges of 250 yards and less, with service lines between Nos. 4 and 7, a 2-inch bronze gun will be sufficient.

It will be seen by comparing the above recommendations with the records of firing that the writer has allowed a wide margin or factor of safety, as far as range is concerned, for even the 2-inch bronze gun (B) has no recorded range of less than 278 yards, and that, too, with a heavy No. 7 line.

I. BRONZE LIFE-SAVING GUNS.

These guns are intended to be used in connection with projectiles having lines attached to them for the purpose of effecting communication between the shore and stranded vessels; or, under favorable circumstances, they may be used on shipboard for throwing lines to the shore. These guns are chill-cast, having smooth bores of 2″, 2″.5, and 3″ in diameter, respectively.

1. 2.5-INCH LIFE-SAVING GUN.

[Model: Bronze gun C. Caliber: 2.5 inches=6.35 centimeters.]

(Plate V.)

The exterior of this gun is divided into four principal parts, viz, the *breech*, the *first reinforce*, the *second reinforce*, and the *chase.*

The breech is a hemisphere, whose radius is equal to the semi-diameter of the first reinforce.

The first reinforce is cylindrical, and extends from the base of the breech to a point in front of the axis of the trunnions.

The second reinforce is a short frustum of a cone, joining the first reinforce to the chase. The latter is cylindrical, and is of a lesser diameter than the first reinforce.

The chase is terminated in front by the *face* of the piece, without any swell of the muzzle or muzzle-band. The cascabel and trunnions are short cylinders.

The rimbases unite with the exterior surface of the gun by tangent-curved surfaces.

The vent-piece is of copper. The vent is perpendicular to the axis of the bore, and is 1.25 inches (=3.175 centimeters) from the bottom of the bore.

The bore is cylindrical, and is terminated at its lower extremity by a hemispherical chamber, by which term it is proposed to designate the bottom of the bore.

Nomenclature.

A—Breech.
B—First reinforce.
C—Second reinforce.
D—Chase.
E—Chamber
F—Bore.
G—Trunnions.
H—Rimbases.
I—Cascabel.
V—Vent.

Dimensions, &c.

	Inches.		Centim'rs.
Diameter of first reinforce	5.5	=	13.97
Diamer of chase	4.5	=	11.43
Diameter of bore	2.5	=	6.35
Diameter of trunnions	2.0	=	5.08
Diameter of rimbases	2.8	=	7.112
Diameter of cascabel	1.5	=	3.81
Diameter of vent	.2	=	.508
Radius of breech	2.75	=	6.985
Radius of chamber	1.25	=	3.175
Radius of chase	2.25	=	5.715
Length of first reinforce	8.50	=	21.59
Length of second reinforce	2.00	=	5.08
Length of chase	9.5	=	24.13
Length of bore, exclusive of chamber	18.75	=	47.624
Total length of bore	20.00	=	50.799
Length of trunnions	2.0	=	5.08
Length of rimbases	.1	=	.254
Length of cascabel	1.5	=	3.81
Distance of vent from bottom of bore	1.25	=	3.175
Distance between the rimbases	5.7	=	14.478
Total length of piece	24.25	=	61.594

Weights.

	Lbs.		Kilos.
Weight of piece	108.25	=	49.096+
Preponderance	1.5	=	0.680+

2. 2-INCH LIFE-SAVING GUN.

[Model: Bronze gun B. Caliber: 2 inches = 5.08 centimeters.]

(Plate IV.)

This gun is of the same general form as gun "C" (2″.5), but is much smaller and lighter.

Nomenclature.

A—Breech.
B—First reinforce.
C—Second reinforce.
D—Chase.
E—Chamber.
F—Bore.
G—Trunnions.
H—Cascabel.
V—Vent.

Dimensions, &c.

	Inches.		Centim'rs.
Diameter of first reinforce	4.0	=	10.16
Diameter of chase	3.5	=	8.89
Diameter of bore	2.0	=	5.08
Diameter of trunnions	1.75	=	4.445
Diameter of cascabel	1.5	=	3.81
Diameter of vent	.2	=	.508
Radius of breech	2.0	=	5.08
Radius of chamber	1.0	=	2.54
Radius of chase	1.75	=	4.445
Length of first reinforce	8.0	=	20.32
Length of second reinforce	1.0	=	2.54
Length of chase	9.0	=	22.86

Length of bore, exclusive of chamber	17.0	=	43.179
Total length of bore	18.0	=	45.719
Length of trunnions	1.5	=	3.81
Length of cascabel	1.5	=	3.81
Distance of vent from bottom of bore	1.25	=	3.175
Distance between the rimbases	4.0	=	10.16
Total length of gun	21.5	=	54.609

Weights.

	Lbs.		Kilos.
Weight of piece	54.25	=	24.607+
Preponderance	1.0	=	.453+

[NOTE.—A 3-inch (=7.62 centimeters) gun may be made differing but slightly in weight and dimensions from the 2½-inch above given. The model is essentially the same in both.]

II. PROJECTILES.

1. 2.5-INCH PROJECTILE.

Diameter, 2.5 inches=6.35 centimeters.

(Plate XXII.)

This is a solid cast-iron shot. The form is cylindro-ogival. A frustum of a cone forms the base.

The radius of the ogival head is equal to one diameter of the shot. A wrought-iron shank is screwed into the base, having an eye at its posterior extremity for attaching the shot-line.

Dimensions.

	Inches.		Centm'rs.
Total length	15.7	=	39.877
Length of ogival head	2.17	=	5.5118
Radius of head	2.5	=	6.350
Length of cylindrical part	12.43	=	31.5712
Diameter of cylindrical part	2.5	=	6.350
Length of frustum	1.1	=	2.794
Diameter of smaller base of frustum	1.35	=	3.429
Shank—Total length	6.5	=	16.510
Length of screw	1.5	=	3.810
Diameter of screw	1.0	=	2.540
Length from plane of base	5.0	=	12.700
Distance from base to center of eye-hole	4.5	=	11.430
Diameter of eye-hole	.4	=	1.016
Width at eye	1.0	=	2.540
Thickness at eye	.4	=	1.016
Diameter of neck	.625	=	1.5875
Distance of center of gravity from plane of base	7.45	=	18.923

Weight.

	Lbs.		Kilos.
Weight, about	19	=	8.61+

2. 2-INCH PROJECTILE.

Diameter, 2 inches=5.08 centimeters.

(Plate XVIII.)

This projectile is similar to the larger calibers, being cylindro-ogival in form, with a conical frustum for its base. The radius of the ogival head is equal to one diameter of the shot. The body is of cast iron.

An axial cavity, bored from the base, runs nearly the whole length of the projectile. Into this cavity melted lead is poured and allowed to cool, after which the shank is screwed in. The lead increases the weight of the shot without increasing its volume.

Dimensions.

	Inches.		Centim'rs.
Total length	15.0	=	38.090
Length of ogival head	1.73	=	4.3942
Radius of head	2.0	=	5.080
Length of cylindrical part	12.27	=	31.1148
Diameter of cylindrical part	2.0	=	5.080
Length of frustum	1.0	=	2.540
Diameter of smaller base of frustum	1.375	=	3.4925
Axial cavity—Total length	13.5	=	34.289
Length filled with lead	12.0	=	30.479
Diameter	1.0	=	2.540
Shank—Total length	6.5	=	16.510
Length of screw-thread	1.5	=	3.810
Diameter (exterior) of screw-thread	1.1	=	2.794
Length from plane of base	5.0	=	12.700
Distance from base to center of eye-hole	4.5	=	11.430
Diameter of eye-hole	.4	=	1.016
Width at eye	1.0	=	2.54
Thickness at eye	.4	=	1.016
Diameter of neck	.5625	=	1.42875
Distance of center of gravity from base	7.0	=	17.78

Weight.

	Lbs.		Kilos.
Weight, a little more than	13	=	5.896

3. 3-INCH PROJECTILE.

Diameter, 3 inches = 7.62 centimeters.

(Plate XI.)

This is an elongated, solid, cast-iron smooth-bore projectile. In form it is cylindro-ogival, with a frustum of a cone for its base.

The radius of the ogival head is equal to the diameter of the shot.

The edges or angles about the base are slightly rounded.

A *shank*, or eye-bolt, of wrought-iron is screwed into the base of the projectile to serve as a point of attachment for the shot-line.

Dimensions.

	Inches.		Centim'rs.
Total length	13.8	=	35.051
Length of ogival head	2.6	=	6.604
Radius of head	3.0	=	7.620
Length of cylindrical part	9.9	=	25.146
Diameter of cylindrical part	3.0	=	7.620
Length of frustum	1.3	=	3.302
Diameter of smaller base of frustum	1.7	=	4.318
Shank—Total length	6.5	=	16.510
Length of screw	1.5	=	3.810
Diameter of screw	1.0	=	2.540
Length from plane of base	5.0	=	12.700
Distance from base to center of eye-hole	4.5	=	11.430
Diameter of eye-hole	.4	=	1.016
Width at eye	1.0	=	2.540
Thickness at eye	.4	=	1.016
Diameter of neck	.625	=	1.5875

Weight.

	Lbs.		Kilos.
Weight about	23	=	10.432

III. GUN-CARRIAGES.

The carriages or beds for these guns are shown in the accompanying drawings, which are sufficiently explanatory. The cheeks and front transom are of wood, and all other parts are made of metal; wrought iron in the two already made.

WEIGHTS.

1. *Carriage for 2.5 and 3 inch guns.*

(Plate XXVII.)

	Lbs.	Kilos.
For gun C, carriage and quoin	54.25	=24.607+
For gun C, carriage alone (49.41 lbs.) say	50.0	=22.68

2. *Carriage for 2-inch gun—(Gun B.)*

(Plate XXVI.)

	Lbs.	Kilos.
Weight of carriage and quoin	35.0	=15.876
Weight of carriage alone	33.5	=15.196

IV. FAKING-BOXES.

Faking-box A should be used for lines Nos. 6 and 7.
Faking-box B, for braided lines Nos. 4 and 4½.
Faking-box C, for braided line No. 5.
Faking-box D, for braided line No. 3½.

V. SHOT-LINES.

The Silver Lake Company's braided linen lines Nos. 3½, 4, 4½, 5, 6, and 7, should be preferred. No. 3½ is advisable where extreme range is required. The others may be used in ordinary cases. The "water-proof finish" should be required.

VI. IMPLEMENTS, &C.

The following list of minor implements and articles should go with each gun:

LIST.

- Sponge and rammer.
- Wiping-rod and wiper.
- 2 priming-wires.
- Lanyard.
- Combination level.
- Gunner's haversack.
- Cartridge-bags, two sizes.
- Friction primers.
- Quick-match for 2″ gun.

VII. SERVICE CHARGES OF POWDER (ORDINARY).

1. For 2″.5 gun.		2. For 2″ gun.	
Number of line.	Weight of powder.	Number of line.	Weight of powder.
	Ounces.		*Ounces.*
3½	4 to 6	3½	3 to 4
4 and 4½	4 to 6	4 and 4½	3 to 4
6 and 7	4 to 8	5, 6, and 7	3 to 6

3. For drills, 3 ounces should be used.

CHAPTER III.

I. INSTRUCTIONS.

Keep the bore of the gun clean at all times. There is often a deposit left after firing, near the seat of the charge, which prevents the projectile from going entirely down to the cartridge. This deposit should always be removed.*

The projectiles should be kept free from rust. The use of emery-cloth and the application of a little oil will protect the shot from rust.

In loading, always measure the distance from the charge to the muzzle with the ramrod or wiper and apply it to the shot. In this manner the gunner can always tell whether the projectile is fully down or is obstructed by dirt or sand.

If the piece be fired when the projectile is not "home," it strains the gun unnecessarily.

II. DIRECTIONS FOR FIRING.

Having the gun and apparatus on the ground, to prepare for firing:

1. Select a place where the gun and carriage may recoil without striking rocks or other obstructions.
2. Note the position of the vessel to be relieved; her distance from the shore, the direction and approximate force of the wind.
3. Place the gun in position, making allowance for the force of the wind and for the drift of the line.
4. Place the faking-box and line on the windward side of the gun, and two or three feet from it—not more. The box should be on a line with the muzzle of the gun. Loosen the hasps, invert the box, and incline it to the front at an angle of about 45°.
5. See that the vent is clear by inserting the priming-wire.
6. Wipe off the shot with care, freeing it from dirt and sand.
7. Remove the frame and faking-pins, pressing at the same time gently upon the "false" bottom to keep the fakes in place. Then remove the "false" bottom by lifting it slowly until clear of the box.
8. Seize the end of the line, drawing out just enough to reach to the gun without disturbing the fakes in the box, pass the end through the eye-hole in the shank and tie two or three half-hitches in it, drawing the knot down close to the eye; then wet about three or four feet of the line.

[The wetting is a precaution that was not taken in the experimental firing, it not being found necessary. It is better, however, to err on the safe side.]

9. Remove the tompion or muzzle cover from the piece.
10. Insert the cartridge.
11. Insert the projectile slowly until it rests upon the cartridge.
12. Prick the cartridge with the priming-wire to avoid disturbing the elevation after being given.
13. Set the "combination level" to the desired angle.
14. Place the lower arm of the level lengthwise upon the chase.
15. Elevate the muzzle until the bubble of the level stands at the middle of the tube.
16. Adjust the quoin.
17. Unroll the lanyard and insert the hook in the wire loop of the friction primer.

* Generally removed by using wet sponge. In very cold weather, alcohol should be used instead of water, to prevent freezing.

18. Insert the primer gently in the vent.
19. Stand clear of the line.
20. Fire the piece.

NOTE.—If any of the fakes should slide from the box to the ground, place the loose line in small fakes not more than 18 inches long in front of the box. The necessity for this operation should be avoided if possible.

III. MANNER OF FAKING.

Faking is an operation which requires some care. Any person may learn to do it in a kind of way, but it requires a man who can exercise a little common sense to do it well. Carelessness and ignorance are the most fruitful causes of want of success in laying up lines by this method. Practice alone can make a successful "faker." One man *may* fake a line, but, having to attend to three operations at the same time, does none of them properly. Two men may put up a line, but, as before, there being more operations than men, they often fail. Three men *can* fake a line well. For convenience of reference, I will number these men Nos. 1, 2, and 3. Their duties will be given here consecutively, but it must be understood that they are performed simultaneously.

Duties of No. 1.

No. 1 is the "faker," and is responsible for the condition in which the line is stowed away. He takes the faking-box, places it on the ground with the side or top uppermost, puts the frame with the pins on top of it, seizes the "false" bottom and lowers it into position over the pins, and stands at the side facing the box. He is now ready to begin faking. The cord or line is supposed to be on the same side of the box as the "faker," and at some distance in rear of him, in coils or upon an improvised reel.

No. 2 stands on the opposite side of the box from No. 1 and facing him.

No. 3 is about two yards behind No. 1, and stands ready to pay out the line from the reel or coil.

No. 1 seizes the end of the line, with his right hand draws it forward, letting it pass close to his right side, lays the end along the "false" bottom with the end to his right. [It was formerly the custom to coil several yards of line loosely upon the "false" bottom before beginning to fake; this should not be done; no more line should be put on the bottom than just sufficient to reach the length of the box, as that length will generally be sufficient to reach from the box to the gun in loading, thus avoiding long fakes on the ground and the disturbance of the fakes in the box.] He then leads the line between the corner and second pins at the left-hand corner of the frame, on the side of No. 2, brings it around the corner pin and between the second and third pins in the end row, thence diagonally across the corner and around the second pin of the side row from left to right (No. 2 holds down this loop), thence back and around third pin of the end row (holding down this loop with the thumb and finger of his left hand); this forms the first fake in the first tier. Repeating this operation, he forms a tier of diagonal fakes and brings up at the right-hand corner on his own side of the box, and passing the line around the second and corner pins of the end row (on the right) between the corner and second pins on the side row next to him, he carries the line along the length of the box, and out between the corner and second pins in the left-hand end row, and around the corner and second pin in the row on the side towards him, thence across the corner and around the second pin in the end row, then back

around the third pin in the side row, forming the first fake of the second tier.

The second tier will end at the right-hand corner on the side opposite the faker, when the line is carried in a similar manner along the frame on the side of No. 2 to the left-hand corner on that side, where the third tier begins.

Thus, it will be seen that the odd numbers of tiers begin at the left-hand corner on the side opposite to the faker, while the second, fourth, sixth, &c., or even numbers of tiers begin always at the left-hand corner on the side upon which the faker stands.

No. 1 continues this operation of faking with his right hand and holding down the loops nearest to him with his left until the pins are filled, then if any line be left unfaked he coils it loosely on top of the tiers and passes the end down on one side to the notch in the "false" bottom.

Nos. 1 and 2 take hold of the frame, one at each end, lift it off the box and place it on the ground.

No. 3 seizes the box and inverts it over the faking-pins and line, with the notched side over the loose end of line, which is allowed to extend out for about a foot. No. 1 holds this end in the notch of the "false" bottom until the box is adjusted in position, when Nos. 2 and 3 close and fasten the hasps. The box and line are now ready for transportation.

Duties of No. 2.

No. 2 takes his place opposite to No. 1, the box with the faking-pins being between them. His duty is to press down and hold the loops in place on his side of the frame as fast as No 1 passes them over the pins; when the faking is completed he assists No. 1 in moving the frame and line from the box to the ground, and fastens the hasp at one end of the box.

Duties of No. 3.

The position of No. 3 is about 6 feet or less in rear of No. 1. He pulls the line from the reel (which may be mounted upon a temporary stand or frame) or coil, disentangles it, removes all knots or kinks, and pays it out to No. 1, who fakes it up. The ease and rapidity with which No. 1 fakes will depend greatly upon the manner in which No. 3 pays out the line. If he does not give enough slack, No. 1 will draw the fakes too tightly around the pins, bending and drawing them together at the top, bringing unnecessary strain upon the frame, and in exceptional cases bending the frame so much that the hasps cannot be fastened. The same effect will be produced if No. 3 permits too much slack, as then the extra weight and effort causes No. 1 to wind too tightly. No. 3 must obey the directions of No. 1 in paying out line, and accommodate himself to the rapidity of action of the faker. Strict attention and frequent practice are necessary to acquire any degree of skill in this manipulation. No. 1 has the tedious and tiresome part to perform in this operation. He must be especially careful not to draw the loops too tightly around the pins; this he unconsciously will be sure to do without the exercise of great caution. He should instruct No. 3 in regard to the rapidity of passing the line. When faking, he should always leave the fakes as loose upon the pins as he thinks is necessary, and then leave them a little looser.

It is almost impossible for one man to fake a line without drawing it too tight; besides which, it is a long and toilsome process. Two men can do it but little better, since No. 2 can render No. 1 no assistance in

drawing the line from the reel or coil. Three men should always be employed when possible. Practice, and a great deal of it, alone can make an expert faker.

Intelligent instruction by illustration should be given to new men until they thoroughly understand the method, for faulty customs and habits when formed are not easily corrected.

Frequent drills in faking should be maintained by the keepers of stations, during which all the surfmen should be taught, not only how to fake, but how to do it well and rapidly.

An ordinary faker with two *good* assistants can put up 600 yards of No. 7 line in from 25 to 28 minutes. A clumsy man will generally be from 40 to 50 minutes putting up the same line.

It must be remarked, however, that the more rapid the faking the greater the danger of getting it too tight upon the pins.

IV. CONCLUSION.

In the use of this, as of all other apparatus, a certain degree of care and common sense must be constantly exercised by those who have it in charge. The best and most perfect apparatus in the world will prove a miserable failure in the hands of ignorance and carelessness. The necessity for thorough instruction and frequent practice is nowhere so urgently called for as in the fitting of men to handle efficiently the appliances for saving human life.

PART II.

CHAPTER I.

BRONZE LIFE-SAVING GUNS.

The term "life-saving guns" is here used to designate such ordnance as may be employed to effect communication between stranded vessels and the shore, by throwing a projectile carrying a line from the shore over a vessel, or from a vessel to the shore.

The guns and mortar treated of in this chapter are given in the chronological order of their preparation for experimental firing.

SECTION I. RIFLED MORTARS.

3-INCH MUZZLE-LOADING RIFLED MORTAR.

(Plate I.)

DESCRIPTION.

This piece is made from an old bronze gun which was found among a lot of captured ordnance. The gun is of an obsolete pattern and its history is unknown. It was prepared under the direction of "The Ordnance Board," United States Army, for making experiments in connection with the United States Life-Saving Service.

The muzzle was cut off 5″.4 from the trunnions, and a muzzle-band or cylindrical (exterior) ring 5″ in length screwed on as shown in the plate (Plate I, Fig. 1).

The rifling consists of 3 grooves, 0″.75 wide and 0″.1 deep. The grooves begin 1″.25 in front of the chamber and reach their full depth at 2″ from the same plane.

The ramp, joining the surfaces of the bore and the bottom of the grooves, is 0″.75 in length.

The grooves are rectangular in section with the corners slightly rounded. The exterior tapers slightly from the base ring to the trunnions. The old vent had been filled up and a new one with a copper bouche inserted.

The axis of the trunnions is below that of the piece. The chamber is cylindro-spherical.

Dimensions.

Total length	26.25 inches.
Total length of bore, including chamber	20.25 inches.
Diameter of base ring	6.2 inches.
Diameter in rear of trunnions	5.1 inches.
Diameter at vent	5.7 inches.
Diameter in front of chamber	5.65 inches.
Diameter at muzzle	5.35 inches.
Diameter of bore	3.0 inches.
Diameter of chamber	2.5 inches.
Total length of chamber	2.75 inches.
Length of cylindrical part of chamber	1.50 inches.

Radius of bottom of chamber	1.25 inches.
Length of trunnions	1.9 inches.
Diameter of trunnions	2.0 inches.
Thickness of metal at vent	1.6 inches.
Thickness of metal in front of chamber	1.32 inches.
Thickness of metal at muzzle	1.1 inches.
Distance of vent from bottom of chamber	1.5 inches.
Number of grooves	3
Depth of grooves	0.1 inch.
Width of grooves	0.75 inch.
Twist, one turn in 10 feet.	
Vent piece, diameter of screw	0.75 inch.
Vent piece, diameter of head	0.85 inch.
Vent, diameter of	0.2 inch.

Weights, &c.

Weight of rifled mortar (converted)	133 pounds.
Preponderance	43.25 pounds.

SECTION II. SMOOTH-BORE GUNS.

Bronze was selected as the metal from which to cast the experimental guns.

The necessary calculations and drawings were made, and copies of the latter, upon tracing-linen, were placed in the hands of the South Boston Iron Company, who had undertaken the fabrication of the guns.

I. BRONZE GUN A.

Caliber, 3 inches=7.62 centimeters (converted).

(Plate II.)

In the plate this gun is represented with the diameter of the bore 2.5 inches. Later, the bore was enlarged to a diameter of 3 inches, as will be seen hereafter, though the total length of the bore remained unaltered.

The exterior of this gun is divided into four principal parts, viz, the *breech*, the *first reinforce*, the *second reinforce*, and the *chase.*

The breech is a hemisphere whose radius is equal to the semi-diameter of the first reinforce.

The first reinforce is cylindrical, and extends from the base of the breech to a point in front of the axis of the trunnions.

The second reinforce is a short frustum of a cone, joining the first reinforce to the chase. The latter is cylindrical, and is of a lesser diameter than the first reinforce.

The chase is terminated in front by the *face* of the piece without any swell of the muzzle or muzzle-band. The cascabel and trunnions are short cylinders.

The rimbases unite with the exterior surface of the gun by tangent-curved surfaces.

The vent-piece is of copper. The vent is perpendicular to the axis of the piece, and is 1.5 inches (3.81 centimeters) from the bottom of the bore.

The bore is cylindrical and is terminated at its lower extremity by a hemispherical chamber, by which term it is proposed to designate the bottom of the bore. The gun was designed for a caliber of 2.5 inches (6.35 centimeters).

When first completed, however, it was bored out to a caliber of only

2 inches (5.08 centimeters), in order to make some preliminary experiments with projectiles of that diameter. It was afterwards bored up to caliber of 2.5 inches, and a series of experiments made. Still later the size of the bore was increased to 3 inches, and half an inch was taken from the length of each trunnion.

The following table gives the respective weights of this gun after the successive operations:

Weights of bronze gun A.

	Actual weight.	Calculated weight.
	Pounds.	*Pounds.*
With bore 2" in diameter	137	132.410+
With bore 2".5 in diameter	127.5	122.467+
With bore 3" in diameter	114	....

The theoretical weight was calculated upon the assumption that the specific gravity of the alloy was 8.7.

PREPONDERANCE.

With 2" caliber, about............ 6 ozs. ("muzzle preponderance.")
With 2".5 caliber.................. 2.5 lbs.
With 3".0 caliber.................. 6.5 lbs.

1. Character of the bronze.

The alloy, as shown by the fracture, appeared to be very homogeneous. The action of the metal in the turning-lathe indicated great toughness. The surfaces of the specimens tested presented after fracture that peculiar blistered appearance and change of form which is usually exhibited by good bronze when subjected to great tensile strain.

This gun was cast muzzle downward, and consequently the "riser," or sinking-head, was in rear of the cascabel. The specimens for testing were taken from that portion of the "riser" which was nearest to the breech of the gun. They were four in number.

Three of the specimens were cut from the exterior of the "riser" equidistant from each other, measured circumferentially; the fourth was an axial specimen from the same mass of metal. (See Plate III, Fig. 1.)

The axes of all the specimens were parallel to the axis of the gun.

Screw-threads were cut upon the heads to fit them to the holders of the testing-machine.

Upon both ends of the pieces were marked the letter A, to designate the gun, the letter H to indicate the sinking-head, from whence they were taken, and the numbers of the specimens.

Dimensions of specimens.

Total length	6.4	inches.
Length of shoulders	0.2	inch.
Length between shoulders	4.0	inches.
Length of heads	1.0	inch.
Diameter	0.798	inch.
Area of cross-section	0.5	inch.
Diameter of heads before cutting thread	1.4	inches.
Diameter of heads after cutting thread	1.25	inches.

(See Plate III, Figs. 1, 2, and 3.)

These carefully turned and finished samples of bronze were placed in the hands of Mr. C. B. Richards, engineer of the Colt's Patent Fire-Arms

Manufacturing Company of Hartford, Conn., to be tested upon the testing-machine constructed by that company. This machine owes its present accuracy and general excellence to the scientific ability of Mr. Richards, under whose supervision it was constructed. In this place a mere abstract of the results of the tests will be given; for further detailed information in regard to the tests and the machine reference must be made to the report of Mr. Richards, which will be found upon subsequent pages.

Tests of metal in bronze gun A.

		912.	913.	914.	915.
Test-number of the specimen		912.	913.	914.	915.
Original mark on the end of the specimen		A. H. 1.	A. H. 2.	A. H. 3.	A. H. 4.
Original minimum diameter of the specimen		0.789	0.797	0.797	0.798
Minimum area of cross-section	Original	0.489	0.499	0.499	0.5
	After fracture	0.283	0.292	0.283	0.418
Distance between gauge-marks	Original	3.49	3.49	3.49	3.49
	After fracture	5.38	5.30	5.38	3.95
Greatest observed stress sustained without set		5500.	6000.	6000.	3500.
Breaking stress		23280.	23340.	23740.	14220.
Elastic resistance, in pounds, per square inch of original cross-section		11000.	12000.	12000.	7000.
Ultimate resistance, in pounds, per square inch of original cross-section		47600.	46780.	47580.	28440.
Greatest reduction of cross-section	per cent	42.1	41.5	43.3	16.4
Ultimate elongation between gauge-marks	per cent	54.1	51.6	53.9	13.3

NOTE.—Dimensions and areas are given in inches and stresses in pounds. No. 915 was the axial specimen.

"The stresses were applied gradually in all cases."

"Observations to ascertain when a permanent set was produced were made after the addition of each 500 pounds stress up to the elastic limit."

"The extensions produced by increasing the stress from 1,000 pounds to 3,000 pounds were as follows:

		912.	913.	914.	915.
Test-number of specimen		912.	913.	914.	915.
Extensions	ten-thousandths of an inch	11.	10.	8.5	10.
Moduli of elasticity	millions of pounds	12.7	14.	16.5	14."

2. MARKS.

The only external mark upon the gun is the letter A on top of the gun between the trunnions.

3. NOMENCLATURE.

A—Breech.
B—First reinforce.
C—Second reinforce.
D—Chase.
E—Chamber.
F—Bore.
G—Trunnions.
H—Cascabel.
I—Rimbases.
V—Vent.

4. NOTATION AND DIMENSIONS.

D = diameter of first reinforce = 6.0 inches.
d_1 = diameter of chase = 4.5 inches.
d_2 = diameter of bore = 2.5 inches.
d_3 = diameter of trunnions = 2.5 inches.
d_4 = diameter of cascabel = 2.0 inches.
d_5 = diameter of rimbases, assumed to be cylinders = 3.5 inches.
R = radius of breech = 3.0 inches.
r = radius of chamber = 1.25 inches.
r^1 = radius of chase = 2.25 inches.
l_1 = length of first reinforce = 7.25 inches.
l_2 = length of second reinforce = 2.0 inches.

l_3=length of chase .... = 8.75 inches.
l_4=length of bore exclusive of chamber .... =16.75 inches.
l_5=length of trunnions .... = 2.5 inches.
l_6=length of cascabel .... = 1.5 inches.
l_7=length of rimbases .... = 0.1 inch.

v_1, v_2, v_3, &c., = volumes of breech, first reinforce, second reinforce, &c., in cubic inches.
x_1, x_2, x_3, &c., = distances of centers of gravity of breech, first reinforce, second reinforce, &c., from plane of reference.

5. CALCULATIONS.

a. Volumes.

A. Breech—hemispherical:
Volume $= \frac{1}{2}\ D^3 \times .5236 = \frac{1}{2} \times 216. \times .5236 = v_1 = 56.5485 \times$ cubic inches.
B. First reinforce—cylindrical:
Volume $= D^2 \times .7854 \times l_1 = 36 \times .7854 \times 7.25 = v_2 = 204.9886$ cubic inches.
C. Second reinforce—frustum of a cone:
Volume $= \frac{1}{3}\ l_2 \times .7854 \left(\frac{D^3 - d_1^3}{D - d_1}\right) = \frac{1}{3}\,.2 \times .7854 \left(\frac{216 - 91.125}{6 - 4.5}\right) = v_3 =$ 43.59 cubic inches.
D. Chase—cylindrical:
Volume $= d_1^2 \times .7854 \times l_3 = 20.25 \times .7854 \times 8''.75 = v_4 = 139.1627$ cubic inches.
E. Chamber—hemispherical:
Volume $= \frac{1}{2}\ d_2^3 \times .5236 = \frac{1}{2}.15.625 \times .5236 = - v_5 = 4.0906$ cubic inches.
F. Bore—cylindrical:
Volume $= d_2^2 \times .7854 \times l_4 = 6.25 \times .7854 \times 1675 = - v_6 = 82.2213$ cubic inches.
G. Trunnions (2)—cylindrical:
Volume $= 2\ d_3^2 \times .7854 \times l_5 = 2 \times 6.25 \times .7854 \times 2''.5 = v_7 = 24.5436$ cubic inches.
H. Cascabel—cylindrical:
Volume $= d_4^2 \times .7854 \times l_6 = 4 \times .7854 \times 1.5 = v_8 = 4.71$ cubic inches.
I. Rimbases (2)—cylindrical (assumed to be):
Volume $= 2d_5^2 \times .7854 \times l_7 = 2 \times 12.25 \times .7854 \times 0''.1 = v_9 = 1.9242$ cubic inches.

Weight.

	Cubic inches.		Cubic inches.
$v_1 =$	56.5486	$- v_5 =$	− 4.0906
$v_2 =$	204.9886	$- v_6 =$	− 82.2213
$v_3 =$	43.5900		(−) 86.3119
$v_4 =$	139.1627		

× 444.2899 = volume of gun less trunnions, rimbases, and cascabel.
(−) 86.3119 = volume of chamber and bore.

× 357.9780 = volume of metal less trunnions, rimbases, and cascabel.
$v_7 =$ 24.5436 = volume of metal in trunnions.
$v_8 =$ 4.7100 = volume of metal in cascabel.
$v_9 =$ 1.9242 = volume of metal in rimbases.

$V = \Sigma(v) =$ 389.1558 = total volume of metal in gun.

$w = 0.3147$ pounds avoirdupois = weight of one cubic inch of bronze whose specific gravity is 8.7.

Hence $W = V \times w = 389.1558 \times .3147$ pound $= 122.467 +$ pounds = weight of gun.

b. Center of gravity.

Assuming the plane YZ, the plane of reference, to coincide with the base of the breech, and the axis of X to coincide with the axis of the bore, then, since the volume is symmetrically disposed in regard to this axis, the center of gravity of the gun will be given by the formula—

$$x = \frac{v_1 x_1 + v_2 x_2 + v_3 x_3 + \&c.}{v_1 + v_2 + v_3 + \&c.}$$

in which

x = the distance of the center of gravity of the gun from the plane of reference, and

v_1, v_2, &c. = the elementary volumes;

x_1, x_2, &c. = the distances of their respective centers of gravity from the plane of reference.

All distances estimated toward the right from the plane YZ are regarded as positive; all estimated toward the left from this plane are regarded as negative.

The volumes of all cavities (such as bore, chamber, &c.) are considered as negative.

The volumes of the trunnions and rimbases are omitted in this computation, since they are symmetrically disposed about a line passing through the center of gravity of the gun, and perpendicular to the axis of the gun.

The cascable is also omitted on account of its small size and weight.

COMPUTATION.

Values of x_1, x_2, x_3, &c.

For—

A. Breech—hemisphere:

$$(-)\, x_1 = \tfrac{3}{8} R = \tfrac{3}{8} \,.\, 3'' = -1''.125.$$

B. First reinforce—cylinder:

$$x_2 = \tfrac{1}{2} l_1 = \tfrac{1}{2} \,.\, 7''.25 = 3''.625.$$

C. Second reinforce—frustum of cone:

$$x_3 = 7''.25 + \tfrac{1}{4} \,.\, l_2 \left(\frac{3r'^2 + 2Rr' + R^2}{R^2 + Rr' + r'^2}\right)$$

$$= 7''.25 + \tfrac{1}{4} \,.\, 2''\left(\frac{15.1875 + 13.50 + 9}{9 + 6.75 + 5.0625}\right)$$

$$= 7''.25 + 0''.9054$$

$$\therefore x_3 = 8''.1554$$

D. Chase—cylinder:

$$x_4 = 9''.25 + \tfrac{1}{2} l_3 = 9''.25 + 4''.375 = 13''.625.$$

E. Chamber—hemisphere:

$$x_5 = 1''.25 - \tfrac{3}{8} r = 1''.25 - .''46875 = 0''.78125.$$

F. Bore—cylinder:

$$x_6 = 1''.25 + \tfrac{1}{2} l_4 = 1''.25 + 8''.375 = 9''.625.$$

Substituting the values of v_1, v_2, &c., and x_1, x_2, &c., in eq., and multiplying, we have—

$$x = \frac{(-63.61735 + 743.0844 + 355.4901 + 1896.0870 - 3.19577 - 791.38)}{56.5485 + 204.9886 + 43.59 + 139.1627 - 4.0906 - 82.2213}$$

or

$x = 5''.968155$, say $x = 5''.97$ = distance of center of gravity of gun from the plane of reference.

6. FABRICATION OF EXPERIMENTAL BRONZE GUN A.

1. *Drawing.*—A full-size drawing of the gun was first made; the dimensions in inches and decimal parts of an inch were marked upon this drawing. An accurate copy of this drawing was made upon tracing-linen and sent to the South Boston Iron Company to guide the founder.

2. *Drawing for the chills.*—The manufacturers prepared a full-size drawing of a set of iron chills in which the gun was to be cast. The dimensions of the chills were such as to allow for the contraction of the metal in cooling, for finishing the gun, and for the sinking-head, or "riser." The chills are made in two parts, which are identical in form.

3. *Pattern.*—From the above drawing, a model or pattern of one-half of the chill was made of white pine, due allowance being made for the shrinkage of the cast-iron in cooling. The model was completed by smoothing it off with sand-paper and varnishing.

4. *Molding.*—From this half-model a mold of one of the half-chills was formed in wooden flasks. This was done by ramming molding-composition compactly around the mold. This composition is a kind of sandy loam, containing just enough clay to make it cohesive when slightly moistened and pressed together. The wooden half-flasks are kept from sticking together by being sprinkled with a dry white sand, called *parting-sand* by molders. The mold for the second half-chill was made in the same manner. The molding being completed, the half-flasks were bolted together, and placed in an oven to dry thoroughly.

5. *Casting the chills.*—When perfectly dry, the flasks containing the molds were removed from the oven, the cast iron was melted and run into them. After cooling, the flasks were removed and the chills were prepared to receive the bronze casting for the gun.

6. *The chills.*—(Fig. 1, plate 47.) These were of cast iron, 1″.75 thick. The total length was 13″ greater than the extreme length of the gun. Of this surplusage, one inch was on the muzzle end, and 12″ at the breech for a sinking-head or "riser." The cavity at the breech end was cylindrical, 6″.5 in diameter; that at the muzzle was a frustum of a cone whose lesser base had a diameter of 5″. The faces of the flanges where the half-chills came together were planed, in order to fit closely. The half-chills were bolted together, and the bottom closed by an iron plate, 1″.75 thick, bolted to the bottom flange.

7. *Heating the chills.*—The inside surfaces of the chills were coated with clay-wash and placed in an oven to dry and become heated before pouring the melted metal for the gun, in order that the exterior should not cool too rapidly. This clay-wash is made by mixing three parts of ground fire-brick with one part of German or English fire-clay, and adding a sufficient quantity of water. When nearly ready to cast the gun, the chill was removed from the oven and taken to a place near the furnaces where the crucibles were heating. A "clay-mold," 6″ in length, whose interior diameter was also 6″, was added to the height of the sinking-head, in order to avoid getting cinders in the metal near the breech of the gun. The chills were so made that the gun was cast muzzle downwards.

8. *The furnaces.*—(Fig. 2, plate 47.) These were iron cylinders, about 3′ high and 2′ in diameter, lined with fire-brick. They are technically called "pots." A high chimney furnished the draught. The gun being a small one, it was unnecessary to use a reverberatory furnace, since three crucibles (Fig. 3, plate 47) would hold the requisite amount o metal. The crucibles were placed in the "pots" and the metals for the alloy melted without difficulty. The fuel used was Lehigh coal, with

broken charcoal put over the metal in the crucibles. The condition of the furnaces or "pots" was such that only two of those in the new foundery could be used. The third crucible had to be heated in a "pot" about forty yards from the others. The isolated "pot" had a less efficient chimney.

9. *Charging the crucibles.*—The metals used were Lake Superior copper and German tin. Both of these metals were in the form of ingots. The copper ingots weighed from 12 to 13 pounds each. The metals were carefully weighed and placed in the crucibles, as stated in the table given below. The tin was removed when the crucibles were placed in the furnace and added subsequently. The proportions of the two metals used were as follows:

Copper	92 per cent.
Tin	8 per cent.

The calculated charge was:

Copper	333.96 lbs.
Tin	29.04 lbs.
Total	363.00 lbs

Actual charges.

Metal.	In crucible.			Total.
	No. 1.	No. 2.	No. 3.	
	Lbs. ozs.	*Lbs. ozs.*	*Lbs. ozs.*	*Pounds.*
Copper	120 00	120 00	94 00	334
Tin	10 7	10 7	8 2	29
Total charge				363

10. *Time of melting, &c.*—The fires were lighted under all the crucibles at 11 a. m. The copper in Nos. 1 and 2 was all melted at 3.15 p. m., while that in No. 3, though a less charge, was not melted on account of a defective draught or some other cause. This necessitated the holding back of Nos. 1 and 2. The charge of No. 3 was finally melted at 4 p. m. On examination, it was found that the metal in No. 2 was not quite hot enough. At 4.15 p. m. the tin was added to the melted copper in the crucibles. The ingots of tin were immersed in the melted copper and stirred up thoroughly as it melted to prevent oxidation.

11. *Casting.*—When ready for casting, crucible No. 3 was lifted from the "pot" and carried through the open air to the room where Nos. 1 and 2 were situated. The pouring ladles were (Fig. 4, plate 47) at hand, filled with burning charcoal, to keep them hot. When all was ready, crucible No. 3 was emptied into ladle No. 1, but not filling it, crucible No. 1 was hoisted out and the ladle filled from it. Ladle No. 2 was then filled with what remained in crucible No. 1 and the contents of No. 2. As soon as both ladles were ready, their contents were, in succession, poured directly into the chills, filling the cavity to the top. The gun was cast at 4.40 p. m. From unskillful manipulation a good many cinders and a good deal of scoria found a passage into the chills. The casting was taken from the chills at 7 to 7.30 a. m. the next morning, and weighed, in a rough state, 363 pounds with the riser. The above weight, 363 pounds, was given by Mr. Reed, the superintendent in charge of the foundery. This first casting was made on October 1, 1877. When the gun came to be turned, it was discovered that the

metal or alloy had not been hot enough when poured, and that charcoal cinders had entered with the molten metal and appeared all along the chase and breech. This casting was rejected. An attempt was now made to prepare a runner-box or receptacle for the metal which should be self-skimming. This was accomplished by placing on top of the sand flask a runner-box having near one side a 2″ hole pierced through the bottom to allow the liquid metal to pass, and on the other side a cup or bowl into which this metal was first poured. A partition a few inches in height separated the two compartments.

Second casting.

Mode of pouring.—The runner box being placed in position upon the flask, the melted metal, in ladles, was then poured, at first slowly, into the cup-shaped receptacle until it rose to the top of the partition and ran over it. The partition was intended to arrest the scoria in the first instants of the casting until enough metal ran over to fill the two-inch hole and rise above it a sufficient distance to preclude any chance of the scoria or cinders getting through the bottom orifice. When the operation had proceeded thus far, all that was necessary was to pour fast enough to keep the metal from falling so low as to permit the residuum to pass before the flask was filled.

Notwithstanding these precautions enough cinders passed into the chills and lodged in the trunnion holes on top (in rear of) of the trunnions to reject this casting also. It was then decided to cut away 0″.375 of the metal in the chills in rear of the trunnions where this lodgment had occurred. This would allow a small lodgment of cinders, &c., without injuring the soundness of the casting.

A third and successful trial was then made. Below are given the charges and dates of the recastings, and a *résumé* of the first trial.

First casting.

Date: October 1, 1877.

	Pounds.
Charge: Copper	334
Tin	29
Total	363

Weight of rough casting, 363 pounds (Reed).

Second casting.

Date: October 4, 1877.

Charge: First casting, weight 363 pounds.
No metal used except the previous casting.

Third casting.

Date: October 8, 1877.

	Pounds.
Charge: Metal from second casting	319
Copper, ingot	17
Tin, ingot	2.9
Total charge	338.9
Weight of rough casting	329
Weight of finished gun bored out to 2 inches caliber	137

Of the 2.9 pounds of tin added to the charge for this casting, 1.4 pounds was the proportion to be added to the 17 pounds of new copper, and 1.5 pounds was about one-half of 1 per cent. of the weight of metal used from second casting. This was added to supply the amount of tin assumed to be lost by oxidation in the two previous castings.

In the third trial the fire was lighted at 10.30 a. m.; metal all melted at 2.30 p. m.; tin added at 2.30 p. m.; gun cast at 3 p. m.

The gun was turned, bored, and finished in the usual manner.

II. BRONZE GUN B.

Caliber: 2 inches = 5.08 centimeters.

(Plate IV.)

This gun is of the same general form as gun A, but is much smaller and lighter. It also was made by the South Boston Iron Company. This piece was cast in chills, muzzle downward, and finished in a similar manner to gun A. The cast-iron chill was 4 inches longer than the length of the gun including the cascabel. A clay mold 8 inches in length was added above the chill to increase the height of the "riser," or sinking-head.

Details of casting.

Date: January 11, 1878.

	Pounds.
Charge of metal	160
Lake Superior copper, 92 per cent	147.2
German tin, 8 per cent	12.8
Total	160.0

Fire lighted in furnace at	8.30 a. m.
Copper charged	9.30 a. m.
Copper melted	1.30 p. m.
Tin added	2.00 p. m.
Gun cast	2.45 p. m.

Weights.

	Pounds.
Weight of rough casting	156.00
Weight of "riser"	40.25
Weight of gun-casting	115.75

Weight of gun.

Specific gravity of alloy, assumed	8.7	pounds.
Theoretical weight of gun	53.279 +	
Actual weight of gun	54.25	
Preponderance	1.0	

1. SPECIMENS FOR TESTING.

(Plate III, Figs. 2, 3, and 4.)

These were four in number, as in the preceding case, and were taken from the "riser" or sinking-head, just in rear of the cascabel. They were of the same size and form, and occupied the same relative positions in the casting as did the specimens from gun A. The heads of each speci-

men were marked with the letters B and H, together with its serial number; No. 4, as in the previous instance, being the number of the axial specimen. The letter B was cut on the top of the gun, between the trunnions.

Below will be found a tabulated statement of the results obtained by the testing-machine. These tests were made by Mr. Richards, engineer of the Colt Company. For further details see his appended report.

Tests of metal from sinking-head of bronze-gun B.

Test-number of specimen		937.	938.	939.	940.
Original mark		B. H. 1.	B. H. 2.	B. H. 3.	B. H. 4.
Diameter of minimum cross-section	Original	0.798	0.798	0.798	0.798
	After fracture	0.66	0.67	0.665	0.73
Area of minimum cross-section	Original	0.500	0.500	0.500	0.500
	After fracture	0.342	0.352	0.347	0.418
Distance between gauge-marks	Original	3.50	3.50	3.50	3.50
	At instant of fract'e	4.69	5.02	4.95	4.07
Greatest observed stress sustained without set		6000.	5500.	6500.	4500.
Breaking stress		20820.	21900.	21920.	16860.
Limit of elastic resistance		12000.	11000.	13000.	9000.
Ultimate resistance (tenacity)		41640.	43800.	43840.	33720.
Greatest reduction of cross-section	per cent	31.6	29.6	30.6	16.4
Ultimate elongation between gauge-marks	per cent	34.0	43.4	41.4	16.3

Dimensions and areas are given in inches, stresses in pounds, and resistances in pounds per square inch of the original cross-section of the specimen.

2. Nomenclature.

A—Breech.
B—First reinforce.
C—Second reinforce.
D—Chase.
E—Chamber.
F—Bore.
G—Trunnions.
H—Cascabel.
V—Vent.

3. Notation and dimensions.

D = diameter of first reinforce = 4 inches.
d_1 = diameter of chase = 3.5 inches.
d_2 = diameter of bore = 2 inches.
d_3 = diameter of trunnions = 1.75 inches.
d_4 = diameter of cascabel = 1.5 inches.
Diameter of vent = 0.2 inch.
R = radius of breech = 2 inches.
r = radius of chamber = 1 inch.
r_1 = radius of chase = 1.75 inches.
l_1 = length of first reinforce = 8 inches.
l_2 = length of second reinforce = 1 inch.
l_3 = length of chase = 9 inches.
l_4 = length of bore, exclusive of the chamber = 17 inches.
l_5 = length of trunnions = 1.5 inches.
l_6 = length of cascabel = 1.5 inches.

v_1, v_2, v_3, &c., = volumes of breech, first reinforce, &c., in cubic inches.

x_1, x_2, x_3, &c., = distances of centers of gravity of breech, first reinforce, &c., from plane of reference.

4. Calculations.

a. Volumes.

A. Breech—hemispherical:

Volume $= \frac{1}{2} D^3 \times .5236 = \frac{1}{2} .64 \times .5236 = v_1 = 16.7552$ cubic inches.

B. First reinforce—cylindrical:

Volume $= D^2 \times .7854 \times l_1 = 16 \times .7854 \times 8 = v_2 = 100.5312$ cubic inches.

C. Second reinforce—frustum of cone:

Volume $= \frac{1}{3} l_2 \times .7854 \times \left(\frac{D_3 - d_1^3}{D - d_1}\right) = .3333 \times .7854 \times \left(\frac{21.125}{0.5}\right) = v_3 =$ 11.0599 + cubic inches.

D. Chase—cylindrical:

Volume $= d_1^2 \times .7854 \times l_3 = 12.25 \times .7854 \times 9 = v_4 = 86.5903 +$ cubic inches.

E. Chamber—hemispherical:

Volume $= \frac{1}{2} d_2^3 \times .5236 = \frac{1}{2} .8 \times .5236 = -v_5 = 2.0944$ cubic inches.

F. Bore—cylindrical:

Volume $= d_2^2 \times .7854 \times l_4 = 4 \times .7854 \times 17 = -v_6 = 53.4072$ cubic inches.

G. Trunnions—cylindrical:

Volume $= 2 \times d_3^2 \times .7854 \times l_5 = 2 \times 3.0625 \times .7854 \times 1.5 = v_7 = 7.2158 +$ cubic inches.

H. Cascabel—cylindrical:

Volume $d_4^2 \times .7854 \times l_6 = 2.25 \times .7854 \times 1.5 = v_8 = 2.6507$ cubic inches

Weight.

	Cubic inches.		Cubic inches.
$v_1 =$	16.7552	$-v_5 =$	− 2.0944
$v_2 =$	100.5312	$-v_6 =$	− 53.4072
$v_3 =$	11.0599		− 55.5016
$v_4 =$	86.5903		

	214.9366	= volume of gun less trunnions and cascabel.
	− 55.5016	= volume of chamber and bore.
	159.4350	= volume of metal less trunnions and cascabel.
$v_7 =$	7.2158	= volume of metal in trunnions.
$v_8 =$	2.6507	= volume of metal in cascabel.
$V = \Sigma(v) =$	169.3015	= whole volume of metal in gun.

$w = 0.3147$ pounds avoirdupois = weight of one cubic inch of bronze, whose specific gravity is 8.7.

Hence $W = V \times w = 169.3015 \times .3147 = 53.279 +$ pounds = weight of gun.

b. Center of gravity.

Assuming the plane YZ, the plane of reference, to coincide with the base of the breech, and the axis of X to coincide with the axis of the bore, then, since the volume is symmetrically disposed in regard to this axis, the center of gravity of the gun will be given by the formula—

$$x = \frac{v_1 x_1 + v_2 x_2 + v_3 x_3 + \text{\&c.}}{v_1 + v_2 + v_3 + \text{\&c.}}$$

in which

$x =$ the distance of the center of gravity of the gun from the plane of reference, and

$v_1, v_2,$ &c. = the elementary volumes;

$x_1, x_2,$ &c. = the distances of their respective centers of gravity from the plane of reference.

All distances estimated toward the right from the plane YZ are regarded as positive; all estimated toward the left from this plane are regarded as negative.

The volumes of all cavities (such as the bore and chamber) are considered as negative.

The volumes of the trunnions are omitted in this calculation, since they are symmetrically disposed about a line passing through the center of gravity of the gun, and perpendicular to the axis of the bore.

The cascabel is omitted on account of its small size. Its weight is insignificant.

COMPUTATION.

Values of x_1, x_2, x_3, &c.

For—

A. Breech—hemisphere:

$$x_1 = \tfrac{3}{8}\,\mathrm{R} = \tfrac{3}{8}\,.\,2'' = -\,0''.75.$$

B. First reinforce—cylinder:

$$x_2 = \tfrac{1}{2}\,l_1 = \tfrac{1}{2}\,.\,8'' = 4''.$$

C. Second reinforce—frustum of cone:

$$x_3 = 8'' + \tfrac{1}{4}\,l_2\left(\frac{3r'^2 + 2\,\mathrm{R}\,r' + \mathrm{R}^2}{\mathrm{R}^2 + \mathrm{R}\,r' + r'^2}\right)$$

$$= 8'' + \tfrac{1}{4}\,.\,1''\left(\frac{9.1875 + 7. + 4}{4 + 3.5 + 3.0625}\right)$$

$$= 8'' + ''.25\left(\frac{20.1875}{10.5625}\right) = 8'' + 0''.4778 +$$

$$\therefore x_3 = 8''.4778 +$$

D. Chase—cylinder:

$$x_4 = 8'' + 1'' + \tfrac{1}{2}\,l_3 = 8'' + 1'' + \tfrac{1}{2}\,.\,9'' = 13''.5.$$

E. Chamber—hemisphere:

$$x_5 = 1'' - \tfrac{3}{8}\,r = 1'' - 0''.375 = 0''.625.$$

F. Bore—cylinder:

$$x_6 = 1'' + \tfrac{1}{2}\,l_4 = 1'' + \tfrac{1}{2}\,.\,17'' = 1'' + 8''.5 = 9''.5.$$

Substituting the values of v_1, v_2, &c., and x_1, x_2, &c., in equation, we have—

$$x = \frac{(16.7552 \times -0''.75) + (100.5312 \times 4'') + (11.0599 \times 8''.4778) + (86.5903 \times 13''.5) + (-2.0944 \times 0''.625) + (-53.4072 \times 9''.5}{16.7552 + 100.5312 + 11.0599 + 86.5903 - 2.0944 - 53.4072.}$$

or,

$$x = \frac{+\,1143.6136}{+\,\;159.435} = 7''.1729 + \text{say } x = 7''.2 =$$

distance of center of gravity from the plane of reference.

III. BRONZE GUN C.

Caliber: 2.5 inches = 6.35 centimeters.

(Plate V.)

The exterior of this gun is divided into four principal parts, viz, the *breech*, the *first reinforce*, the *second reinforce*, and the *chase*.

The breech is a hemisphere whose radius is equal to the semi-diameter of the first reinforce.

The first reinforce is cylindrical, and extends from the base of the breech to a point in front of the axis of the trunnions.

The second reinforce is a short frustum of a cone, joining the first reinforce to the chase. The latter is cylindrical, and is of a lesser diameter than the first reinforce.

The chase is terminated in front by the *face* of the piece without any swell of the muzzle or muzzle-band. The cascabel and trunnions are short cylinders.

The rimbases unite with the exterior surface of the gun by tangent-curved surfaces.

The vent piece is of copper. The vent is perpendicular to the axis of the bore, and is 1.25 inches (= 3.175 centimeters) from the bottom of the bore.

The bore is cylindrical, and is terminated at its lower extremity by a hemispherical chamber, by which term it is proposed to designate the bottom of the bore.

1. Details of casting.

This gun was cast in the chill made for casting gun A.

Three castings were made before a satisfactory gun ingot was obtained.

First casting.

Date: March 23, 1878.

	Pounds.
Charge of metal	350
Lake Superior copper 90 per cent	315
German tin 10 per cent	35
Total	350
Fire lighted in furnace at	6.30 a. m.
Copper charged	7.00 a. m.
Copper melted	9.30 a. m.
Tin added	9.55 a. m.
Gun cast	10.40 a. m.
Amount of coal used	250 pounds.

Three crucibles were used in melting the charge: two "No. 60" crucibles, containing 99 pounds of copper and 11 pounds of tin, each; and one "No. 70," containing 117 pounds of copper and 13 pounds of tin.

Weights.

	Pounds.
Weight of rough ingot	347
Weight of "riser"	117
Weight of rough casting	230

This ingot was rejected on account of being porous at the breech.

Second casting.

Date: March 28, 1878.

	Pounds.
Charge of metal from former casting	345
Weight of rough ingot	338

Casting rejected, porous around trunnions.

Third casting.

Date: March 30, 1878.

	Pounds.
Charge of metal from preceding casting	338
Lake Superior ingot copper	13.5
German tin, ingot	1.5
Total charge	353.0

Fire lighted in furnace at	7 a. m.
Copper charged at	8 a. m.
Copper melted at	11 a. m.
Gun cast at	11.30 a. m.

Weights.

	Pounds.
Weight of rough casting	347
Weight of finished gun	108.25
Preponderance	1.5

A few spots of tin showed on the exterior surface of the gun just in front of the right trunnion.

This gun is marked with the letter C on its upper surface between the trunnions.

2. Specimens for testing.

(Plate III, Figs. 2, 3, and 5.)

The specimens for testing were similar to those for the preceding guns. The marks on the heads of the specimens are given in Fig. 5, Plate III.

For details of the tests in this case, see appended report of Mr. C. B. Richards.

3. Nomenclature.

A—Breech.	F—Bore.
B—First reinforce.	G—Trunnions.
C—Second reinforce.	H—Rimbases.
D—Chase.	I—Cascabel.
E—Chamber.	V—Vent.

4. Notation and dimensions.

D = diameter of first reinforce	= 5.5	inches.
d_1 = diameter of chase	= 4.5	inches.
d_2 = diameter of bore	= 2.5	inches.
d_3 = diameter of trunnions	= 2	inches.
d_4 = diameter of rimbases [true diameter = 2″.8], assumed	3	inches.
d_5 = diameter of cascabel	= 1.5	inches.
R = radius of breech	= 2.75	inches.
r = radius of chamber	= 1.25	inches.
r' = radius of chase	= 2.25	inches.
l_1 = length of first reinforce	= 8.50	inches.
l_2 = length of second reinforce	= 2	inches.
l_3 = length of chase	= 9.5	inches.
l_4 = length of bore exclusive of the chamber	= 18.75	inches.
l_5 = length of trunnions	= 2	inches.
l_6 = length of rimbases	= 0.1	inches.
l_7 = length of cascabel	= 1.5	inches.

v_1, v_2, v_3, &c., = volumes of breech, first reinforce, second reinforce, &c., in cubic inches.

x_1, x_2, x_3, &c., = distances of centers of gravity of breech, first reinforce, second reinforce, &c., from plane of reference.

5. Calculations.

a. Volumes.

A. Breech—hemispherical:

Volume $= \frac{1}{2}$ D$^3 \times .5236 = \frac{1}{2}\ 166.375 \times .5236 = v_1 = 43.557$ cubic inches.

B. First reinforce—cylindrical:

Volume $=$ D$^2 \times .7854 \times l_1 = 30.25 \times .7854 \times 8''.5 = v_2 = 201.9458$ cubic inches.

C. Second reinforce—frustum of cone:

Volume $= \frac{1}{3} l_2 \times .7854 . \left(\frac{D_3 - d_1^3}{D - d_1}\right) = .6666 \times .7854 \times 75.25 = v_3 = 39.401$ cubic inches.

D. Chase—cylindrical:

Volume $= d_1^2 \times .7854 \times l_3 = 20.25 \times .7854 \times 9''.5 = v_4 = 151.0916$ cubic inches.

E. Chamber—hemispherical:

Volume $= \frac{1}{2} . d_2^3 \times .5236 = \frac{1}{2} . 15.625 \times .5236 = - v_5 = 4.0906 +$ cubic inches.

F. Bore—cylindrical:

Volume $= d_2^2 \times .7854 \times l_4 = 6.25 \times .7854 \times 18''.75 = - v_6 = 92.0391 +$ cubic inches.

G. Trunnions (2)—cylindrical:

Volume $= 2 . d_3^2 \times .7854 \times l_5 = 2 \times 4 \times .7854 \times 2''. = v_7 = 12.5664$ cubic inches.

H. Rimbases (2)—assumed cylindrical:

Volume $= 2 d_4^2 \times .7854 \times l_6 = 2 \times 9 \times .7854 \times 0''.1 = v_8 = 1.4137 +$ cubic inches.

I. Cascabel—cylindrical:

Volume $= d_5^2 \times .7854 \times 1''.5 = 2.25 \times .7854 \times 1.5 = v_9 = 2.6507 +$ cubic inches.

Weight.

Cubic inches.	Cubic inches.
$v_1 = 43.5570$	$- v_5 = 4.0906$
$v_2 = 201.9458$	$- v_6 = 92.0391$
$v_3 = 39.4010$	$-$ 96.1297
$v_4 = 151.0916$	
$v_7 = 12.5664$	
$v_8 = 1.4137$	
$v_9 = 2.6507$	

$+$ 452.6262 = total volume of gun.
$-$ 96.1297 = volume of bore and chamber.

$V = \Sigma (v) = 356.4965 =$ total volume of metal in gun.
$w = 0.3147$ pound avoirdupois = weight of one cubic inch of bronze whose specific gravity is 8.7.

Hence $V \times w = 356.4965$ cubic inches $\times\ 0.3147 = 112.1896 +$ pounds = weight of gun.

b. Center of gravity.

Making the same assumptions and using the same notation, and, in addition, omitting the volumes of the rimbases, the center of gravity is found in a similar manner to that of gun B.

COMPUTATION.

Values of x_1, x_2, x_3, &c.

For—

A. Breech—hemisphere:

$$x_1 = \tfrac{3}{8}\,\mathrm{R} = \tfrac{3}{8}.\,2''.75 = -\,1''.03125.$$

B. First reinforce—cylinder:

$$x_2 = \tfrac{1}{2}.\,l_1 = \tfrac{1}{2}.\,8''.5 = 4''.25.$$

C. Second reinforce—frustum of cone:

$$x_3 = 8''.5 + \tfrac{1}{4}\,l_2\left(\frac{3\,r'^2 + 2\,\mathrm{R}\,r' + \mathrm{R}^2}{\mathrm{R}^2 + \mathrm{R}\,r' + r'^2}\right) =$$

$$= 8''.5 + \tfrac{1}{4}\,.\,2''.0\left(\frac{15.1875 + 12.375 + 7.5625}{7.5625 + 6.1875 + 5.0625}\right) =$$

$$= 8''.5 + 0''.5\left(\frac{35.1250}{18.8125}\right) = 8''.5 + 0''.9335 = 9''.4335 +$$

$$\therefore x_3 = 9''.4335 +$$

D. Chase—cylinder:

$$x_4 = 8''.5 + 2''.0 + \tfrac{1}{2}\,l_3 = 8''.5 + 2''.0 + \tfrac{1}{2}\,.\,9''.5 = 15''.25.$$

E. Chamber—hemisphere:

$$x_5 = 1''.25 - \tfrac{3}{8}\,r = 1''.25 - 0''.46875 = 0''.78125.$$

F. Bore—cylinder:

$$x_6 = 1''.25 + \tfrac{1}{2}\,.\,l_4 = 1''.25 + \tfrac{1}{2}\,.\,18''.75 = 10''.625.$$

Substituting the values of v_1, v_2, &c., and x_1, x^1, &c., in the general formula, we have—

$$x_1 = \frac{(43.577 \times -1''.03125) + 201.9458 \times 4''.25) + (39.401 \times 9''.4335) + (151.0916 \times 15''.25) + -4.0906 \times 0''.78125) + -92.0391 \times 10''.625)}{+43.557 + 201.9458 + 39.401 + 151.0916 - 4.0906 - 92.0391}$$

or,

$$x_1 = \frac{2497.6883}{339.8657} = +\,7''.349,$$

say $x_1 = +\,7''.35$ = distance of center of gravity from the plane of reference.

CHAPTER II.

LIFE-SAVING PROJECTILES.

The experimental projectiles, both rifle and smooth bore, are numbered in one series, corresponding to the order in which they were made. This series comprises projectiles of all calibers made for the experiments.

SECTION I. RIFLE PROJECTILES.*

I. EXPERIMENTAL PROJECTILE No. 1.

(Plate VI.)

This is a cast-iron projectile and was finished when received. It was one of a lot of similar projectiles prepared under the direction of the Ordnance Board for like experiments.

* These projectiles were used with 3-inch M. L. rifled mortar.

It is cylindrical, with sphero-segmental head. This shot is cast with a core, which leaves a hole through the shot from end to end. This hole is cylindrical for 2″.5 from the base; at which distance there is an annular shoulder ″.25 wide, whose outer circle forms the smaller base of the frustum of a cone, in which the hole is continued to the head of the shot.

The cylindrical part of this axial cavity is 2″.5 long and ″.6 in diameter; the conical (a frustum) part is 10″.75 long, with diameters of 1″.1 and 1″.3 at the smaller and larger ends, respectively. The base of this frustum is at the head of the shot. A straight groove, ″.6 wide and ″.5 deep, runs the whole length of the shot and is parallel to the axis. The bottom of this groove is circular.

A radial slot 1″ deep and ″.6 wide connects the longitudinal groove with the axial cavity.

The rifled motion is given by two rings of copper or brass studs, three in each ring. The distance between the two rings of studs is 6″.25, and the rear ring is situated 3″.15 from the base of the shot. The studs are radial, and are screwed into the shot.

The bearing edges of the studs are filed parallel to the line joining their centers. Within the axial cavity are contained a rubber plug and a lead washer, through both of which the cord or line to be projected passes. The opening at the head of the shot is closed by a sheet-iron cap. This cap consists of a cylindrical body, on one end of which is brazed a circular head. The head, from its greater diameter, projects as a flange, which latter is curved downwards so as to embrace the point of the shot. The body has a hole pierced in one side to receive the screw which holds the cap in place when the shot is fired from the piece. This screw passes through the wall of the shot near the front end of the longitudinal groove, and its head is countersunk in the metal at the bottom of this groove.

1. Weights, dimensions, &c.

Projectile.

Total length	13.25 inches.
Diameter of body	2.94 inches.
Diameter of body over studs	3.12 inches.
Radius of head	1.47 inches.
Distance of center of gravity from base	6.30 inches.
Distance of first row of studs from base	3.15 inches.
Distance between first and second row of studs	6.25 inches.
Number of studs	6
Number of studs in each row	3
Height of studs	0.09 inch.
Width of studs	0.69 inch.
Front stud to right of rear stud (both for same groove)	0.5 inch.
Angle due to one turn in 10 feet	4° 30′
Weight, about	18 pounds.

2. Cap (sheet-iron).

Body—Diameter	1.28 inches.
Length	1.2 inches.
Head—Diameter	1.7 inches.

3. Washer (lead).

Diameter	1. inch.
Thickness	0.25 inch.
Diameter of hole	0.5 inch.

4. Rubber plugs.

Diameter—Greatest	1.2 inches.
Least	1.07 inches.
Length	from 2 inches to 6 inches.
Diameter of longitudinal hole	0.5 inch.

5. Marks.

Only two of these shot were made and finished. They are marked on one of the rear studs C. 1 and C. 2, respectively.

II. EXPERIMENTAL PROJECTILE No. 2.

(Plate VII.)

This projectile is of the same general form as the preceding one. It differs only in the weight, and in the details of its dimensions and construction. The metal is cast iron except the studs, which are of brass. The following table and the drawings are sufficiently explanatory.

1. Dimensions, weight, &c.

Total length	10.3 inches.
Diameter of body	2.94 inches.
Diameter of body over studs	3.14 inches.
Radius of head	1.47 inches.
Distance of center of gravity from base	5. inches.
Distance of first row of studs from base	2.50 inches.
Distance between first and second row of studs	5. inches.
Number of studs	6
Number of studs in each row	3
Height of studs	0.10 inch.
Width of studs	0.69 inch.
Front stud to right of rear stud (both for same groove)	0.40 inch.
Angle due to one turn in 10 feet	4° 30′.
Longitudinal groove for short line—Length	Length of shot.
Width*	0.40 inch.
Depth*	0.37 inch.
Axial cavity—Cylindrical portion, diameter of	0.60 inch.
Counterbore, front end, diameter of	1. inch.
Counterbore, front end, length of	2. inches.
Weight	16 pounds.

2. Cap. (sheet-iron.)

Body—External diameter	1. inch.
Length	1.1 inches.
Head, diameter of	1.3 inches.

3. Washer. (brass.)

Diameter	1. inch.
Thickness	0.15 inch.
Diameter of hole	0.3 inch.

4. Marks.

Two shot of this pattern and size were made. They are marked on the rear studs as follows, viz: one, C. L. 3; the other, C. L. 4.

* The radial slot in the base has the same width and depth.

SECTION II. SMOOTH-BORE PROJECTILES.

I. 3-INCH SMOOTH-BORE PROJECTILES.

1. EXPERIMENTAL PROJECTILE NO. 3.*

(Plate VIII.)

This is an elongated solid, cast-iron smooth-bore projectile. In form, it is cylindro-ogival with a frustum of a cone for its base. The radius of the ogival head is equal to the diameter of the shot.

The edges or angles about the base are slightly rounded.

A *shank*, or eye-bolt, of wrought iron is screwed into the base of the projectile to serve as a point of attachment for the shot-line.

1. *Dimensions.*

Total length	13.8 inches.
Length of ogival head	2.6 inches.
Radius of head	3. inches.
Length of cylindrical part	9.9 inches.
Diameter of cylindrical part	3. inches.
Length of frustum	1.3 inches.
Diameter of smaller base of frustum	1.7 inches.
Shank: Total length	2.7 inches.
Length of screw	1.5 inches.
Diameter of screw	0.5 inch.
Length from plane of base	1.2 inches.
Distance from base to center of eye-hole	0.7 inch.
Diameter of eye-hole	0.4 inch.
Width at eye	1. inch.
Thickness at eye	0.4 inch.
Diameter of neck	0.625 inch.
Weight, about	22 pounds.

2. *Marks.*

Two of these shot were made and marked as follows: first, C. 5; second, C. 6.

2. EXPERIMENTAL PROJECTILE NO. 4.

(Plate IX.)

The form and dimensions of the body of this shot are identical with those of "experimental projectile No. 3" (which see). The only difference is in the shank. The details of this projectile are fully shown in the drawing.

1. *Dimensions of shank, &c.*

Total length of shank, including screw	11.5	inches.
Length of screw-thread	1.5	inches.
Diameter of screw	0.5	inch.
Length of shank	10.	inches.
Diameter of shank	0.625	inch.
Diameter of eye-hole	0.4	inch.
Width at eye-hole	1.	inch.
Thickness at eye-hole	0.4	inch.
Distance from plane of base to center of eye	9.5	inches.
Distance of center of gravity from plane of base	5.97	inches.
Weight, about	22	pounds.

*This and the two succeeding projectiles were made for 3″ M. L. rifled mortar.

2. *Marks.*

One shot, marked C. 7.

3. EXPERIMENTAL PROJECTILE No. 5.

(Plate X.)

This shot also differs from No. 3 only in the length and details of the shank.

1. *Dimensions of shank, &c.*

Total length of shank, including screw	7.5	inches.
Length of screw-thread	1.5	inches.
Diameter of screw	0.5	inch.
Length of shank	6.	inches.
Diameter of shank	0.625	inch.
Diameter of eye-hole	0.4	inch.
Width at eye-hole	1.	inch.
Thickness at eye-hole	0.4	inch.
Distance from plane of base to center of eye	5.5	inches.
Distance of center of gravity from plane of base	6.2	inches.
Weight, about	22	pounds.

2. *Marks.*

Two shot made, marked, respectively, C. 8 and C. 9.

4. EXPERIMENTAL PROJECTILE No. 17.*

(Plate XI.)

This is a cast-iron projectile whose body has the same form and dimensions as "experimental projectile No. 3." The shank, however, is different, being longer, and having the portion which screws into the shot much larger. For convenience all the dimensions are here given.

1. *Dimensions.*

Total length	13.8	inches.
Length of ogival head	2.6	inches.
Radius of head	3.	inches.
Length of cylindrical part	9.9	inches.
Diameter of cylindrical part	3.	inches.
Length of frustum	1.3	inches.
Diameter of smaller base of frustum	1.7	inches.
Shank: Total length	6.5	inches.
Length of screw	1.5	inches.
Diameter of screw	1.	inch.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.625	inch.
Weight, about	23	pounds.

2. *Marks.*

Five of these shot were made, and marked serially from C. 10 to C. 14, both inclusive.

* This form used with gun "A" bored to a caliber of 3 inches.

II. 2-INCH SMOOTH-BORE PROJECTILES.

These projectiles were fabricated for use in connection with experimental bronze gun "A," which was first bored out to a caliber of 2 inches.

1. EXPERIMENTAL PROJECTILE No. 6.

(Plate XII.)

This 2-inch shot is made of solid wrought iron. It is cylindro-ogival in form. The base is the frustum of a cone. The radius of the head is equal to one diameter of the shot. It has a wrought-iron shank like the 3-inch smooth-bore projectiles, to which it is similar in all respects except in material.

1. *Dimensions.*

Total length	13.	inches.
Length of ogival head	1.73	inches.
Radius of head	2.	inches.
Length of cylindrical part	10.27	inches.
Diameter of cylindrical part	2.	inches.
Length of frustum	1.	inch.
Diameter of smaller base of frustum	1.	inch.
Shank: Total length	6.5	inches.
Length of screw	1.5	inches.
Diameter of screw	0.5	inch.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.625	inch.
Distance of center of gravity from base	6.22	inches.
Weight, about	10	pounds.

2. *Marks.*

One shot made, marked LL. 1.

2. EXPERIMENTAL PROJECTILE No. 7.

(Plate XIII.)

The body of this one is the same as the preceding, but the shank differs somewhat. All the dimensions of the body are identical with those of No. 6.

1. *Dimensions of shank, &c.*

Total length	3.5	inches.
Length of screw	1.5	inches.
Diameter of screw	0.5	inch.
Length from plane of base	2.	inches.
Distance from base to center of eye-hole	1.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.625	inch.
Distance of center of gravity from base	6.25	inches.
Weight, about	10	pounds.

2. *Marks.*

Two shot, LL. 2, and LL. 3.

3. Experimental projectile No. 8.

(Plate XIV.)

This shot has the same exterior form and dimensions as No. 6. The body is made of cast iron. A cylindrical cavity, whose axis is coincident with that of the shot, is bored out and filled with lead. This cavity occupies about two-thirds of the length of the projectile, and is drilled from the head or front end. A plug of wrought-iron screws into the open end, closing the cavity and forming the point of the shot. The shank, or eye-bolt, is of wrought iron. The details of construction are given in the drawings.

1. *Dimensions.*

Total length	13.	inches.
Length of ogival head	1.73	inches.
Radius of head	2.	inches.
Length of cylindrical part	10.27	inches.
Diameter of cylindrical part	2.	inches.
Length of frustum	1.	inch.
Diameter of smaller base of frustum	1.	inch.
Point of projectile—Total length	1.53	inches.
Head (ogival): Length	0.53	inch.
Diameter of base	1.20	inches.
Body (cylindrical): Length	1.	inch.
Diameter	1.10	inches.
Axial cavity (cylindrical): Total length	9.	inches.
Length filled with lead	8.	inches.
Diameter	1.	inch.
Shank: Total length	6.5	inches.
Length of screw	1.5	inches.
Diameter of screw	6.5	inch.
Length from plane of base of shot	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.625	inch.
Distance of center of gravity from base ("LL. 4")	6.25	inches.
Distance of center of gravity from base ("LL. 5")	6.38	inches.
Weight, about	10	pounds.

2. *Marks.*

Two shot made, marked LL. 4 and LL. 5.

4. Experimental projectile No. 9.

(Plate XV.)

This is a cast-iron projectile and is cast solid. The exterior is cylindro-ogival with a part of the point removed. A groove is planed along one side of the shot, parallel to the axis, for the accommodation of the shot-line. A transverse slot is cut in the rear end of the projectile to connect the axial cavity with the longitudinal groove.

The axial cavity is bored out and has the front end counterbored for the reception of the brass washer and the knot on the end of the line.

The cavity is closed in front by a cap held in position by a side screw.

1. *Weights, dimensions, &c.*

Total length	13. inches.
Diameter of body	1.995 inches.
Radius of head	1.995 inches.
Distance of center of gravity from base	6.25 inches.
Longitudinal groove for shot-line: Length	Length of shot.
Width	0.40 inch.
Depth	0.35 inch.
Groove in base for shot-line: Width	0.40 inch.
Depth	0.35 inch.
Axial cavity, cylindrical portion: Diameter	0.60 inch.
Counterbore, front end: Diameter	1. inch.
Length	1.50 inches.
Weight	8.75 pounds.

2. *Cap.* (*Sheet-iron.*)

Body: External diameter	1.0 inch.
Length	1.1 inches.
Head: Diameter of	1.3 inches.

3. *Washer.* (*Brass.*)

Diameter	1.0 inch.
Thickness	0.15 inch.
Diameter of hole	0.30 inch.

4. *Marks.*

Two shot were made, marked respectively LL. 6 and LL. 7.

5. EXPERIMENTAL PROJECTILE No. 13.*

(Plate XVI.)

The exterior dimensions of this shot are the same as those of No. 8. The shank in this instance extends axially through the entire length of the projectile. The front end of the shank is so shaped as to form the point of the projectile. The entire body of the projectile is of lead. The body is kept from turning on the shank by flattening the latter and raising some barbs on the angles with a cold-chisel.

1. *Dimensions.*

Point of projectile: Length of head	0.8 inch.
Diameter of base	1.55 inches.
Shank: Total length	18. inches.
Length from base	5. inches.
Distance from base to center of eye-hole	4.5 inches.
For other dimensions see "experimental projectile No. 8," and plate above cited.	
Weight	14.25 pounds.

2. *Marks.*

One shot, marked LL. O.

6. EXPERIMENTAL PROJECTILE No. 14.*

(Plate XVII.)

This is similar to projectile No. 8, from which it differs by having a heavier shank, and by having the axial cavity for the lead bored from

* Made for gun B.

the base of the shot. This leaves the head of the shot solid and diminishes the labor of manufacture. The dimensions wherein this projectile differs from No. 8 are given below. (See "Ex. proj. No. 8.")

1. *Dimensions.*

Diameter of small base of frustum	1.375	inches.
Axial cavity: Total length	11.5	inches.
Length filled with lead	10.	inches.
Diameter	1.	inch.
Shank: Diameter (exterior) of screw-thread	1.1	inches.
Diameter of neck	0.5625	inch.
Weight, about	11.	pounds.

2. *Marks.*

One shot made, marked LL. 8.

7. Experimental projectile No. 15.*

(Plate XVIII.)

This projectile is cylindro-ogival in form, with a frustum of a cone for its base. The body is of cast iron. An axial cavity is bored from the base nearly the whole length of the shot. Into this cavity melted lead is poured and allowed to cool, after which the shank is screwed in. The lead increases the weight of the shot without increasing its volume.

1. *Dimensions.*

Total length	15.	inches.
Length of ogival head	1.73	inches.
Radius of head	2.	inches.
Length of cylindrical part	12.27	inches.
Diameter of cylindrical part	2.	inches.
Length of frustum	1.	inch.
Diameter of smaller base of frustum	1.375	inches.
Axial cavity: Total length	13.5	inches.
Length filled with lead	12.	inches.
Diameter	1.	inch.
Shank: Total length	6.5	inches.
Length of screw-thread	1.5	inches.
Diameter (exterior) of screw-thread	1.1	inches.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.5625	inch.
Distance of center of gravity from base	7.	inches.
Weight, a little over	13	pounds.

2. *Marks.*

Six of these projectiles were made and marked, consecutively, from LL. 9 to LL. 14, both numbers inclusive.

III. 2.5-INCH SMOOTH-BORE PROJECTILES.

These projectiles were fabricated for use with experimental bronze gun A, after it was bored out to a caliber of 2.5 inches.

*Made for gun B.

1. Experimental projectile No. 10.

(Plate XIX.)

This is a 2.5-inch projectile made of solid cast iron. The form is cylindro-ogival. A frustum of a cone forms the base.

The radius of the ogival head is equal to one diameter of the shot. A wrought-iron shank is screwed into the base, having an eye at its posterior extremity for attaching the line. For details of construction, see plate.

1. *Dimensions.*

Total length	13.3	inches.
Length of ogival head	2.17	inches.
Radius of head	2.5	inches.
Length of cylindrical part	10.03	inches.
Diameter of cylindrical part	2.5	inches.
Length of frustum	1.1	inches.
Diameter of smaller base of frustum	1.35	inches.
Shank: Total length	6.5	inches.
Length of screw	1.5	inches.
Diameter of screw	0.5	inch.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.5625	inch.
Distance of center of gravity from base	6.3	inches.
Weight, about	15	pounds.

2. *Marks.*

Two shot made, marked L. 1 and L. 2.

2. Experimental projectile No. 11.

(Plate XX.)

This is, also, a 2.5-inch projectile, made of solid cast iron. The body of this shot has the same form as that of No. 10, and differs only in the length and weight.

The ogival head is identical with that of No. 10. The wrought-iron shank, or eye-bolt, differs slightly from the one attached to the preceding shot, in that the screw-thread is shorter and the neck extends into the base of the projectile for 0″.4 without diminution of diameter. The hole in the base is counterbored to accommodate the increased size. The details are given in the following table of dimensions and upon the drawing of the projectile.

1. *Dimensions.*

Total length	14.7	inches.
Length of ogival head	2.17	inches.
Radius of head	2.5	inches.
Length of cylindrical part	11.43	inches.
Diameter of cylindrical part	2.5	inches.
Length of frustum	1.1	inches.
Diameter of smaller base of frustum	1.35	inches.
Total length of hole for shank	1.5	inches.
Length of female screw	1.1	inches
Length of counterbore	0.4	inch.
Diameter of female screw-hole	0.5	inch.
Diameter of counterbore	0.5625	inch

Shank: Total length	6.5	inches
Length of screw	1.1	inches.
Diameter of screw	0.5	inch.
Length of neck inserted in base of shot	0.4	inch.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.5625	inch.
Distance of center of gravity from base	7.	inches.
Weight, about	17	pounds

2. *Marks.*

One shot made, marked L. 3.

3. EXPERIMENTAL PROJECTILE No. 12.

(Plate XXI.)

The length and weight of this projectile are greater than in the preceding one. In form and material it is the same. The shanks are also similar in every respect. The quantities given in the following table are the only ones in which this shot differs from projectile No. 11. (See plate.)

1. *Dimensions, &c.*

Total length	15.7	inches.
Length of cylindrical part	12.43	inches.
Distance of center of gravity from base	7.45	inches.
Weight, about	18	pounds.

2. *Marks.*

One shot made, marked L. 4.

4. EXPERIMENTAL PROJECTILE No. 16.*

(Plate XXII.)

This cast-iron shot is similar to No. 12, but it has a stronger shank. The details of form are fully shown in the plate.

1. *Dimensions.*

Total length	15.7	inches.
Length of ogival head	2.17	inches.
Radius of head	2.5	inches.
Length of cylindrical part	12.43	inches.
Diameter of cylindrical part	2.5	inches.
Length of frustum	1.1	inches.
Diameter of smaller base of frustum	1.35	inches.
Shank: Total length	6.5	inches.
Length of screw	1.5	inches.
Diameter of screw	1.	inch.
Length from plane of base	5.	inches.
Distance from base to center of eye-hole	4.5	inches.
Diameter of eye-hole	0.4	inch.
Width at eye	1.	inch.
Thickness at eye	0.4	inch.
Diameter of neck	0.625	inch.
Distance of center of gravity from plane of base	7.45	inches
Weight, about	19	pounds.

* Made for gun C.

2. *Marks.*

Nine shot made, numbered, serially, from L 5 to L 13, both inclusive.

Table of rifle projectiles.

Dimensions, &c.		Experimental projectiles. No. 1.	Experimental projectiles. No. 2.
Number of projectiles made		2	2
Caliber	inches	3	3
	centimeters	7. 62	7. 62
Marks, both inclusive		C. 1 and C. 2	C. L. 3 and C. L. 4
Total length	inches	13. 25	10. 3
	centimeters	33. 654	26. 162
Diameter of body	inches	2. 94	2. 94
	centimeters	7. 468	7. 468
Radius of head	inches	1. 47	1. 47
	centimeters	3. 734	3. 734
Distance of center of gravity from base	inches	6. 3	5.
	centimeters	16.	12. 70
Distance of first row of studs from base	inches	3. 15	2. 5
	centimeters	8.	6. 35
Distance between two rows of studs	inches	6. 25	5.
	centimeters	15. 875	12. 70
Number of studs		6.	6.
Number of studs in each row		3.	3.
Height of studs	inch	0. 09	0. 1
	centimeter	0. 229	0. 254
Width of studs	inch	0. 69	0. 69
	centimeters	1. 753	1. 753
Front stud to right of rear stud (both of same groove)	inch	0. 5	0. 4
	centimeters	1. 27	1. 016
Angle due to 1 turn in 10 feet (3.048 meters)		4° 30′	4° 30′
Longitudinal groove for shot-line:			
Width	inch	0. 6	0. 4
	centimeters	1. 524	1. 016
Depth	inch	0. 5	0. 37
	centimeters	1. 27	0. 94
Radial slot in base:			
Width	inch	0. 6	0. 4
	centimeters	1. 524	1. 016
Depth	inch	1.	0. 3
	centimeters	2. 54	0. 762
Axial cavity:			
Cylindrical part, diameter	inch	0. 6	0. 6
	centimeters	1. 524	1. 524
Counterbore front end—			
Diameter	inch	....	1.
	centimeters	....	2. 54
Length	inches	....	2.
	centimeters	....	5. 08
Weight, about	pounds	18.	16.
	kilograms	8. 16	7. 26

Weights of rifle projectiles.

Number.	Marks.	Weight. Pounds.	Weight. Kilograms.
1	C. 1	18.	8. 159
2	C. 2	17. 75	8. 051
3	C. L. 3	16.	7. 258
4	C. L. 4	16. 25	7. 371

Table of 3-inch smooth-bore projectiles.

Dimensions, &c.		Experimental projectiles.			
		No. 3.	No. 4.	No. 5.	No. 17.
Number of projectiles made		2	1	2	5
Caliber	inches	3.	3.	3.	3.
	centimeters	7.62	7.62	7.62	7.62
Marks, both inclusive		C. 5 and C. 6	C. 7	C. 8, C. 9	C. 10 to C. 14
Total length	inches	13.8	13.8	13.8	13.8
	centimeters	35.051	35.051	35.051	35.051
Length of ogival head	inches	2.6	2.6	2.6	2.6
	centimeters	6.604	6.604	6.604	6.604
Radius of head	inches	3.	3.	3.	3.
	centimeters	7.62	7.62	7.62	7.62
Length of cylindrical part	inches	9.9	9.9	9.9	9.9
	centimeters	25.146	25.146	25.146	25.146
Diameter of cylindrical part	inches	3.	3.	3.	3.
	centimeters	7.62	7.62	7.62	7.62
Length of frustum	inches	1.3	1.3	1.3	1.3
	centimeters	3.302	3.302	3.302	3.302
Diameter of smaller base of frustum	inches	1.7	1.7	1.7	1.7
	centimeters	4.318	4.318	4.318	4.318
Shank:					
Total length	inches	2.7	11.5	7.5	6.5
	centimeters	6.858	29.209	19.05	16.51
Length of screw	inches	1.5	1.5	1.5	1.5
	centimeters	3.81	3.81	3.81	3.81
Diameter of screw	inch	0.5	0.5	0.5	1.
	centimeters	1.27	1.27	1.27	2.54
Length from plane of base	inches	1.2	10.	6.	5.
	centimeters	3.048	25.4	15.24	12.7
Distance from base to center of eye-hole	inches	0.7	9.5	5.5	4.5
	centimeters	1.778	24.13	13.97	11.43
Diameter of eye-hole	inch	0.4	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	1.016
Width at eye	inch	1.	1.	1.	1.
	centimeters	2.54	2.54	2.54	2.54
Thickness at eye	inch	0.4	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	1.016
Diameter of neck	inch	0.625	0.625	0.625	0.625
	centimeters	1.587	1.587	1.587	1.587
Distance of center of gravity from base	inches	....	5.97	6.2	....
	centimeters	....	15.164	15.748	....
Weight, about	pounds	22.	22.	22.	23.
	kilograms	9.979	9.979	9.979	10.433

Weights of 3-inch smooth-bore projectiles.

Number.	Marks.	Weight.	
		Pounds.	Kilograms.
1	C. 5	21.75	9.866
2	C. 6	21.75	9.866
3	C. 7	22.25	10.093
4	C. 8	21.875	9.922
5	C. 9	22.25	10.093
6	C. 10	22.59	10.248
7	C. 11	22.97	10.419
8	C. 12	23.062	10.46
9	C. 13	22.625	10.263
10	C. 14	22.906	10.39

Table of 2-inch smooth-bore projectiles.

Dimensions, &c.		Experimental projectile.						
		No. 6.	No. 7.	No. 8.	No. 9.	No. 13.	No. 14.	No. 15.
					Cordes.			
Number of projectiles made		1	2	2	2	1	1	6
Caliber	inches	2.	2.	2.	2.	2.	2.	2.
	centimeters	5.08	5.08	5.08	5.08	5.08	5.08	5.08
Marks, both inclusive		LL. 1	LL. 2 and LL. 3	LL. 4 and LL. 5	LL. 6 and LL. 7	LL. 0	LL. 8	LL. 9 to LL. 14
Total length	inches	13.	13.	13.	13.	13.	13.	15.
	centimeters	33.019	33.019	33.019	33.019	33.019	33.019	38.099
Length of ogival head	inches	1.73	1.73	1.73	....	1.73	1.73	1.73
	centimeters	4.394	4.394	4.394	....	4.394	4.394	4.394
Radius of head	inches	2.	2.	2.	1.995	2.	2.	2.
	centimeters	5.08	5.08	5.08	5.067	5.08	5.08	5.08
Length of cylindrical part	inches	10.27	10.27	10.27	....	10.27	10.27	12.27
	centimeters	26.086	26.086	26.086	....	26.086	26.086	26.086
Diameter of cylindrical part	inches	2.	2.	2.	1.995	2.	2.	2.
	centimeters	5.08	5.08	5.08	5.067	5.08	5.08	5.08
Length of frustum	inches	1.	1.	1.	....	1.	1.	1.
	centimeters	2.54	2.54	2.54	....	2.54	2.54	2.54
Diameter of smaller base of frustum.	inches	1.	1.	1.	....	1.	1.375	1.375
	centimers	2.54	2.54	2.54	....	2.54	3.493	3.493
Shank:								
Total length	inches	6.5	3.5	6.5	....	18.	6.5	6.5
	centimeters	16.51	8.89	16.51	....	45.719	16.51	16.51
Length of screw	inches	1.5	1.5	1.5	....	....	1.5	1.5
	centimeters	3.81	3.81	3.81	....	....	3.81	3.81
Diameter of screw	inches	0.5	0.5	0.5	....	....	1.1	1.1
	centimeters	1.27	1.27	1.27	....	....	2.794	2.794
Length from plane of base.	inches	5.	2.	5.	....	5.	5.	5.
	centimeters	12.7	5.08	12.7	....	12.7	12.7	12.7
Distance from base to center of eye-hole.	inches	4.5	1.5	4.5	....	4.5	4.5	4.5
	centimeters	11.43	3.81	11.43	....	11.43	11.43	11.43
Diameter of eye-hole	inch	0.4	0.4	0.4	....	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	....	1.016	1.016	1.016
Width at eye	inch	1.	1.	1.	....	1.	1.	1.
	centimeters	2.54	2.54	2.54	....	2.54	2.54	2.54
Thickness at eye	inch	0.4	0.4	0.4	....	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	....	1.016	1.016	1.016
Diameter of neck	inch	0.625	0.625	0.625	....	0.625	0.5625	0.5625
	centimeters	1.587	1.587	1.587	....	1.587	1.429	1.429
Distance of center of gravity from base.	inches	6.22	6.25	6.25 6.38	6.25	6.25	....	7.
	centimeters	15.799	15.875	15.875 16.205	15.875	15.875	....	17.78
Weight, about	pounds	10.	10.	10.	8.75	14.25	11.	13.
	kilograms	4.536	4.536	4.536	3.963	6.464	4.99	5.897

Weights of 2-inch smooth-bore projectiles.

Number.	Marks.	Weight.		Remarks.
		Pounds.	Kilograms.	
1	LL. 1	10.406	4.72	Wrought iron.
2	LL. 2	10.437	4.734	Do.
3	LL. 3	10.375	4.706	Do.
4	LL. 4	10.406	4.72	Axial cavity.
5	LL. 5	10.562	4.799	Do.
6	LL. 6	8.75	3.963	Modified Cordes shot.
7	LL. 7	8.75	3.963	Do.
8	LL. 0	14.25	6.464	Made of lead.
9	LL. 8	11.156	5.06	Axial cavity.
10	LL. 9	13.156	5.967	Axial cavity, 13″.5 long.
11	LL. 10	13.156	5.967	Do.
12	LL. 11	13.156	5.967	Do.
13	LL. 12	13.219	5.996	Do.
14	LL. 13	13.281	6.024	Do.
15	LL. 14	13.25	6.01	Do.

Table of 2.5-inch smooth-bore projectiles.

Dimensions.		Experimental projectile.			
		No. 10.	No. 11.	No. 12.	No. 16.
Number of projectiles made		2	1	1	9
Caliber	inches	2.5	2.5	2.5	2.5
	centimeters	6.35	6.35	6.35	6.35
Marks, both inclusive		L. 1 & L. 2	L. 3	L. 4	L. 5 to L. 13
Total length	inches	13.3	14.7	15.7	15.7
	centimeters	33.781	37.337	39.877	39.877
Length of ogival head	inches	2.17	2.17	2.17	2.17
	centimeters	5.512	5.512	5.512	5.512
Radius of head	inches	2.5	2.5	2.5	2.5
	centimeters	6.35	6.35	6.35	6.35
Length of cylindrical part	inches	10.03	11.43	12.43	12.43
	centimeters	25.476	29.031	31.571	31.571
Diameter of cylindrical part	inches	2.5	2.5	2.5	2.5
	centimeters	6.35	6.35	6.35	6.35
Length of frustum	inches	1.1	1.1	1.1	1.1
	centimeters	2.794	2.794	2.794	2.794
Diameter of smaller base of frustum	inches	1.35	1.35	1.35	1.35
	centimeters	3.429	3.429	3.429	3.429
Shank:					
Total length	inches	6.5	6.5	6.5	6.5
	centimeters	16.51	16.51	16.51	16.51
Length of screw	inches	1.5	1.1	1.1	1.5
	centimeters	3.81	2.794	2.794	3.81
Diameter of screw	inch	0.5	0.5	0.5	1.
	centimeters	1.27	1.27	1.27	2.54
Length from plane of base	inches	5.	5.	5.	5.
	centimeters	12.70	12.70	12.7	12.7
Distance from base to center of eye-hole	inches	4.5	4.5	4.5	4.5
	centimeters	11.43	11.43	11.43	11.43
Diameter of eye-hole	inch	0.4	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	1.016
Width at eye	inch	1.	1.	1.	1.
	centimeters	2.54	2.54	2.54	2.54
Thickness at eye	inch	0.4	0.4	0.4	0.4
	centimeters	1.016	1.016	1.016	1.016
Diameter of neck	inch	0.5625	0.5625	0.5625	0.625
	centimeters	1.429	1.429	1.429	1.587
Distance of center of gravity from base	inches	6.3	7.	7.45	7.45
	centimeters	16.	17.78	18.923	18.923
Weight, about	pounds	15.	17.	18.	19.
	kilograms	6.804	7.711	8.159	8.618

Weights of 2.5-inch smooth-bore projectiles.

No.	Marks.	Weight.		Remarks.	
		Pounds.	*Kilos.*	*Pounds. Kilos.*	
1	L. 1	15.406	6.998	15.5 =7.031	Weights after being fitted with the shank used in experimental projectile No. 16. The new shanks were put in before sending them to Sandy Hook.
2	L. 2	15.406	6.998	15.562=7.059	
3	L. 3	17.109	7.761	17.343=7.867	
4	L. 4	18.437	8.357	18.531=8.400	
5	L. 5	18.75	8.499		
6	L. 6	18.75	8.499		
7	L. 7	18.75	8.499		
8	L. 8	18.75	8.499		
9	L. 9	18.781	8.513		
10	L. 10	18.75	8.499		
11	L. 11	18.75	8.499		
12	L. 12	18.75	8.499		
13	L. 13	18.75	8.499		

CHAPTER III.

GUN-CARRIAGES.

SECTION I.—CARRIAGES FOR 3-INCH M. L. RIFLED MORTAR.

I. CARRIAGE No. 1.

(Plate XXIII.)

The 3-inch M. L. rifled mortar was mounted on this carriage when received. The carriage had been used in making some preliminary experiments before being sent to the National Armory.

It consists of two cheeks and three transoms made of oak; and of two trunnion plates, two cap-squares, twelve assembling bolts, twelve washers and twelve nuts, made of wrought iron.

The front and rear transoms project beyond the cheeks to form handles for convenience of transportation.

The middle transom is placed vertically between the cheeks, and is almost directly beneath the trunnions.

The ends of this transom are let into the cheeks. Two assembling bolts passing through the cheeks, and longitudinally through this (middle) transom, give rigidity to the cheeks.

The nuts and ends of the assembling bolts, which project below the cheeks, tend to check the recoil by sinking into the earth or sand.

The drawings furnish the dimensions and the details of construction.

Weight of carriage and quoin, 77 pounds.

II. CARRIAGE No. 2.

(Plate XXIV.)

This carriage was made at the National Armory. It differs in some of the details of its construction from carriage No. 1.

The cheeks are thicker, are not so long, and the number of parts is diminished. Iron handles are placed at the sides to be used in moving the gun and carriage from place to place.

The following are the component parts of this carriage, namely:

Two cheeks and front transom of wood (oak); two trunnion plates, two cap-squares, four handles, twelve assembling bolts, twelve nuts, one washer, and one rear transom of wrought iron.

A wooden quoin is used for giving elevations.

Weight of carriage and quoin, 68 pounds.

(See plate for dimensions, &c.)

SECTION II.—CARRIAGES FOR SMOOTH-BORE GUNS.

The carriages or beds for the smooth-bore bronze guns were all made at the National Armory, Springfield, Mass. The materials are oak and wrought iron.

I. CARRIAGE FOR BRONZE GUN A.

(Plate XXV.)

Nomenclature.

a. Wood.

2 cheeks, same size.
1 front transom.
1 quoin.

b. Wrought iron.

2 trunnion plates, same size.
2 cap-squares, same size.
2 hinge plates, same size.
2 hinge pins, same size (riveted).
2 cap-square keys, same size (rotating).
4 assembling bolts, long, same size.
4 assembling bolts, short, same size.
1 assembling bolt, transverse.
2 washers.
8 nuts.
1 rear transom.
4 handles.
2 cheek bands.

The two rear assembling bolts (long) screw into the hinge plates.

The cap-square keys rotate about the front assembling bolts (long) and lock the cap-squares when in position.

The cheek bands pass around the edges of the cheeks and are fastened to the latter by wood-screws.

These bands are made to fit closely.

The dimensions and details of the construction are given in the plate. Weight of carriage and quoin, 63 pounds.

II. Carriage for bronze gun B.

(Plate XXVI.)

This carriage is similar in form to the preceding one, but is smaller and lighter. The rods that serve as handles for transportation are made long, in order that the load may be balanced by slipping the hands along the rods when two men carry the gun and carriage with the projectiles lying on the rear transom.

The nomenclature of this and the following carriage is the same as that of gun A.

Weight of carriage and quoin .... 35 pounds.
Weight of carriage alone .... 33.5 pounds.

(For details see plate.)

III. Carriage for bronze gun C.

(Plate XXVII.)

This carriage differs but slightly from that designed for gun A.

The trunnion beds and transoms in this carriage are placed farther forward, and the cheeks are cut away more in rear of the trunnions.

The drawings give all the details of construction and the dimensions

Weight of carriage and quoin .... 54.25 pounds.
Weight of carriage alone (49.41 pounds), say .... 50 pounds.

Recapitulation of the weights of gun-carriages.

No.	Gun-carriage, with quoin.	Weight. Pounds.	Weight. Kilograms.	Remarks.
1	No. 1 for 3″ M. L. R. mortar	77	34.93	
2	No. 2 for 3″ M. L. R. mortar	68	30.84	
3	For S. B. gun A	63	28.58	
4	For S. B. gun B	35	15.88	Without quoin, 33.5 pounds (15.2 kilos).
5	For S. B. gun C	54.25	24.61	Without quoin, 50 pounds (22.68 kilos).

CHAPTER IV.

POWDER, AND CARTRIDGE BAGS.

I. POWDER.

Two kinds of powder were used during the first series of experiments: Dupont's mortar powder and Hazard's United States Government musket powder.

The Dupont mortar powder used was a sample on hand when the experiments began.

The qualities of the Hazard musket powder used in this series of experiments are shown below in the report of Mr. R. T. Hare, in charge of the experimental apparatus at this armory. The arm and ammunition used, though not conforming to the actual conditions of service with life-saving guns and projectiles, afford relative tests of the values of different powders.

The pressures in all cases were taken with the Rodman pressure plug, with musket housing, using the National Armory circular cutter. There was no "internal-pressure gauge" suitable for use with the life-saving guns. The Le Boulengé chronograph, the Benton electro-ballistic machine, and the Benton thread velocimeter were employed in obtaining the initial velocities. These machines were used simultaneously for taking velocities.

Record of initial velocities.

[Station: National Armory, Springfield, Mass. Date: February 26, 1878. Kind of arm: Springfield rifle. Ammunition: Prepared. Weight of powder: 70 grains. Kind of powder: Hazard's United States Government musket. Weight of ball: 405 grains. Object of experiment: To test velocity, pressure, and specific gravity of powder. Specific gravity: 1.80.]

Number of shot.	Le Boulengé.	Electro-ballistic.	Thread velocimeter.	Pressures per square inch.
	Feet.	*Feet.*	*Feet.*	*Pounds.*
1	1381.0	1393.2	1369.2	....
2	1330.8	1333.7	1334.9	....
3	1344.6	1345.3	1340 5	28,000
4	1361.2	1363.1	1357.5	27,000
5	1359.3	1363.1	1363.2	28,200
Mean	1355.3	1359.6	1353.0	27,733
Extreme variation .	50.2	59.5	34	....
Mean variation	7	8	6	....

Distance between targets for Le Boulengé: 98 feet. Distance between targets for electro-ballistic: 97 feet. Distance between targets for thread velocimeter: 100 feet. By whom taken: R. T. Hare.

Second series of experiments.

Four kinds of powder were procured from the Hazard Powder Company for this series of experiments, namely:

1. F. G., duck size ("Sea shooting duck").
2. U. S. Government musket.
3. Mortar.
4. Navy cannon.

The tests, as before, were made by Mr. Hare. They are given serially below.

The coarser grained powders were slightly compressed in putting up the metallic cartridges, which somewhat affected the resulting velocities and pressures.

No. 1.

Record of initial velocities.

[Station: National Armory, Springfield, Mass. Date: April 30, 1878. Kind of arm: Springfield rifle. Ammunition: Prepared. Weight of powder: 70 grains. Kind of powder: Hazard sample, marked F. G., Duck Size.* Weight of ball: 405 grains. Object of experiment: To test velocity, pressure, and specific gravity of powder. Specific gravity: 1.79263.]

Number of shot.	Le Boulengé.	Electro-ballistic.	Thread velocimeter.	Pressures per square inch.
	Feet.	*Feet.*	*Feet.*	*Pounds.*
1	1325.9	1322.4	1323.7	31,000
2	1318.1	1316.7	1318.3	28,000
3	1335.7	1333.7	1334.9	25,700
4	1335.7	1339.4	1334.9	....
5	1335.7	1339.4	1329.3	....
Mean................	1330.2	1330.3	1328.2	28,233
Extreme variation....	17.6	22.7	16.6	....
Mean variation.......	3.2	4.3	2.8	....

* Sometimes called "Sea Shooting Duck."

Distance between targets for Le Boulengé: 98 feet. Distance between targets for electro-ballistic: 97 feet. Distance between targets for thread velocimeter: 100 feet. By whom taken: R. T. Hare.

No. 2.

Record of initial velocities.

[Station: National Armory, Springfield, Mass. Date: April 30, 1878. Kind of arm: Springfield rifle Ammunition: Prepared. Weight of powder: 70 grains. Kind of powder: Hazard's sample, marked Musket Powder. Weight of ball: 405 grains. Object of experiment: To test velocity, pressure, and specific gravity of powder. Specific gravity: 1.81132.]

Number of shot.	Le Boulengé.	Electro-ballistic.	Thread velocimeter.	Pressures per square inch.
	Feet.	*Feet.*	*Feet.*	*Pounds.*
1	1354.4	1351.2	1375.0	33,900
2	1353.4	1351.2	1346.1	33,900
3	1367.1	1375.1	1375.0	33,900
4	1356.3	1363.1	1363.3	....
5	1357.3	1357.1	1351.7	....
Mean................	1357.7	1359.5	1362.2	33,900
Extreme variation....	13.7	23.9	28.9	....
Mean variation.......	3	3.8	5.3	....

Distance between targets for Le Boulengé: 98 feet. Distance between targets for electro-ballistic: 97 feet. Distance between targets for thread velocimeter: 100 feet. By whom taken: R. T. Hare.

No. 3.

Record of initial velocities.

[Station: National Armory, Springfield, Mass. Date: April 30, 1878. Kind of arm: Springfield rifle. Ammunition: Prepared. Weight of powder: 70 grains. Kind of powder: Hazard's sample, marked Mortar Powder. Weight of ball: 405 grains. Object of experiment: To test velocity, pressure, and specific gravity of powder. Specific gravity: 1.91202.]

Number of shot.	Le Boulengé.	Electro-ballistic.	Thread velocimeter.	Pressures per square inch.
	Feet.	*Feet.*	*Feet.*	*Pounds.*
1	1300.5	1300.3	1296.9	24,500
2	1307.0	1311.1	1313.0	25,000
3	1289.7	1294.8	1286.5	25,000
4	1313.2	1322.4	1307.6	....
5	1297.5	1300.3	1307.6	....
Mean	1301.5	1305.7	1302.3	25,000
Extreme variation ...	23.5	27.6	26.5	....
Mean variation	3.4	4.5	4.2	....

Distance between targets for Le Boulengé: 98 feet. Distance between targets for electro-ballistic: 97 feet. Distance between targets for thread velocimeter: 100 feet. By whom taken: R. T. Hare.

No. 4.

Record of initial velocities.

[Station: National Armory, Springfield, Mass. Date: April 30, 1878. Kind of arm: Springfield rifle. Ammunition: Prepared. Weight of powder: 70 grains. Kind of powder: Hazard's sample, marked Navy Cannon. Weight of ball: 405 grains. Object of experiment: To test velocity, pressure, and specific gravity of powder. Specific gravity: 1.77061.]

Number of shot.	Le Boulengé.	Electro-ballistic.	Thread velocimeter.	Pressures per square inch.
	Feet.	*Feet.*	*Feet.*	*Pounds.*
1	1359.3	1357.1	1351.7	28,500
2	1328.9	1333.7	1334.9	29,500
3	1350.4	1363.1	1340.5	27,500
4	1329.9	1339.4	1323.7	....
5	1350.5	1322.4	1318.3	....
Mean	1343.8	1343.1	1333.8	28,500
Extreme variation ...	30.4	40.7	33.4	....
Mean variation	5.7	6.8	5.1	....

Distance between targets for Le Boulengé: 98 feet. Distance between targets for electro-ballistic: 97 feet. Distance between targets for thread velocimeter: 100 feet. By whom taken: R. T. Hare.

II. Cartridge bags.

(Plate XXVIII, Figs. 1, 2.)

The cartridge bags are made of twilled serge, or some other woolen material.

The texture should be close enough to prevent the powder from sifting through.

Each bag is made of two pieces, identical in size and shape; one end of each half-bag is semicircular. The half-bags are cut out by means of sheet-iron or tin patterns. Marks for the seams are traced out by the cutter.

The seams are half an inch from the edge. After sewing, the edges are turned down on the same side of the seam and basted, to keep the powder from escaping through the seam.

Two sizes of bags are used.

Dimensions (of half cartridge bag).

For 3″ gun (Fig. 1).

	Inches.	Centimeters.
Length	7.5	19.05
Width	4.5	11.43

For 2″ and 2″.5 guns (Fig. 2).

	Inches.	Centimeters.
Length	7.0	17.78
Width	3.8	9.65

Shorter cartridge bags may be used for practice with small charges.

CHAPTER V.

SABOTS, FRICTION PRIMERS, AND IMPLEMENTS.

I. SABOTS.

(Plate XXIX.)

1. Three-inch sabots, wood. These were circular disks of dry pine. Two thicknesses were made, 0″.75 and 0″.5. (Figs. 1–4.)
2. Three-inch sabots, Cordes. This sabot is 3″ in diameter and 0″.55 thick. It has a disk of iron placed between two disks of sole leather, the whole held together by a copper rivet. (Figs. 5, 6.)
3. Two-inch sabots. Two kinds of sabots of this diameter were made; one was a plain wooden sabot and the other a Cordes sabot, similar to those above described. (See Figs. 7–10.)
4. Wads. In firing rifle projectiles and when using smooth-bore projectiles with the rifled mortar, wads of paper (newspapers) were used without any previous preparation.

II. FRICTION PRIMERS, ETC.

Three kinds of primers were used during the experiments, namely:

1. Service friction primer, short.
2. Service friction primer, long.
3. Electric primers.

III. PRIMING WIRE.

(Plate XXVIII, Fig. 3.)

This implement is made of brass or steel wire 0″.15 in diameter, and is 7″.7 in length.* One end is pointed and the other is formed into a ring 2″.25 in diameter.

* Length 9″.7 in figure, but it has been found to be too long for convenience.

IV. Sponge and rammer.

(Plate III, Fig. 6.)

This is a staff of ash or elm 30″ long. The rammer head is cylindrical, 4″ long and 1″.75 in diameter. The end for the sponge is also cylindrical, and is 5″ in length with a diameter of 1″.5. The shaft between the heads is turned down to a diameter of 1″.25.

The sponge-head is made of coarse, well-twisted woolen yarn woven into a kind of webbed cloth, or of sheepskin with the wool on.

The thickness of the sponge-head may be so regulated that the same rammer may be used for the 2″ and 2″.5 guns.

V. Powder measures.

These are made of sheet-copper or brass. Two sizes are made, one holding one ounce (avoirdupois) of powder (size of Navy cannon*), and the other two ounces.

VI. Lanyard.

This is made of strong cod-line or of Nos. 3½, 4, or 4½ Silver Lake Company's braided linen line. A small hook of iron wire with an eye for the line is attached to one end of the lanyard, and to the other end a wooden toggle, 4″ long and 0″.75 in diameter. The lanyard should be 30 feet long. It is used for pulling off the friction primers.

VII. Combination level.

(Plate XXVIII, Fig. 4.)

This is a foot-rule made of box-wood and bound with brass. It is a combination rule, level, and octant. A steel arm which closes like a knife blade is graduated into degrees from 0° to 45°. Half degrees may be estimated. It is used for obtaining elevations of guns and mortars when the chase or exterior near the muzzle in cylindrical. In the figure it is shown in position for an elevation of 30 degrees.

VIII. Gunner's haversack.

(Plate XXX.)

This haversack is intended to be used for carrying cartridges, friction primers, lanyards, priming wire, and the combination level. It is made of black bridle-leather, except the pocket for the friction primers, which is made of black grain leather.

The back, bottom, front, and flap are cut in one piece. The ends are lined with leather to give them the requisite stiffness. On the inside of one end is a pocket for the combination level.

The inside flap has small pads sewed to the ends of the upper part to screen the inside of the haversack from the effects of a driving rain. Two loops are sewed or riveted to the back for the reception of the waist-belt. A tongue or "billet" fastens the outside flap to a brass button on the bottom. Sheaths for the priming-wire are sewed to each corner at the back of the haversack. A waist-belt and buckle complete the equipment. (For dimensions, &c., see plate.)

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* Hazard's Life-Saving Service powder is now used.

Nomenclature.

(Plate XXX.)

Fig. 1. Flap, back, bottom, and front, one piece.
Fig. 2. Inside flap.
Fig. 3, *a. b.* Pads on inside flap near top; should be same size.
Figs. 4, 5. Ends; lined.
Fig. 6. Pocket in front.
Fig. 7. Pocket for level.
Fig. 8. Lining for bottom.
Fig. 9. Sheath for priming-wire; one at each end.
Fig. 10. Tongue or billet.
Fig. 11. Loops for waist-belt; two.
Fig. 12. Waist-belt and buckle.
Fig. 13. View of haversack, complete.

NOTE.—If made for the service, the haversack will be made of russet leather.

CHAPTER VI.

SHOT-LINES.

These lines are intended to be used in connection with a gun or mortar and a projectile, to effect communication between the shore and stranded vessel, or, in exceptional cases, between vessels at sea.

They should be made of the very best materials.

The English method of faking has been adopted in laying up these lines for firing.

Rockets may be used instead of a gun and projectile for carrying the line.

The lines used in each series of experiments are given separately.

SECTION I.—LINES USED IN FIRST SERIES.

The cords or lines used in the first series of experiments were made expressly for the United States life-saving service.

The materials used were stated to be the best linen and Italian hemp thread. The cords are *braided* instead of being twisted, and each cord is made in one continuous piece. The first four lines were sent to the writer by Capt. J. H. Merryman, United States Revenue Marine, inspector of the life-saving service. These four lines are numbered serially for reference; the linen and hemp lines having a separate set of numbers. The manufacturer's numerical notation, when given, indicates the diameter of the line expressed in 32ds of an inch. Thus, when a line is designated as "No. 7," a line $\frac{7}{32}$ds of an inch in diameter is meant. The linen shot-lines had invariably a smooth finish; the hemp lines appeared to be less smooth upon the exterior.

1. *Linen line No.* 1.

Manufacturer unknown, probably Silver Lake Company, of Newtonville, Mass.

Maker's number not given, probably No. 7.

Theoretical diameter	0.21875	inch.
Measured diameter	0.22	inch.
Length	600	yards.
Weight of line	34	pounds.
Weight of faking-box, A 1	37	pounds.
Weight of faking-box and line	71	pounds.

2. *Linen line No.* 2.

Manufacturer unknown, probably Silver Lake Company.
Maker's number, No. 7.

Theoretical diameter	0.21875	inch.
Measured diameter	0.22	inch.
Length	600	yards.
Weight of line	33	pounds.
Weight of faking-box, A 2	36.5	pounds.
Weight of faking-box and line	69.5	pounds.

3. *Italian hemp line No.* 1.

Manufacturer unknown, probably Silver Lake Company.
Maker's number not given, probably No. 4½.

Theoretical diameter	0.125	inch.
Measured diameter	0.13	inch.
Length	700	yards.
Weigh of line	16	pounds.
Weight of faking-box, B 1	24	pounds.
Weight of faking-box and line	40	pounds.

4. *Italian hemp line No.* 2.

Manufacturer unknown, probably Silver Lake Company.
Maker's number not given, probably No. 4½.

Theoretical diameter	0.125	inch.
Measured diameter	0.13	inch.
Length	700	yards.
Weight of line	13.5	pounds.
Weight of faking-box, B 2	24	pounds.
Weight of faking-box and line	37.5	pounds.

5. *Linen line No.* 3.

This small line was made especially for trial with a light gun to ascertain the maximum range that could be obtained without breaking the line, and also to learn if so small a line would stand the shock of discharge. It was made of bleached linen thread under the direction of Mr. H. W. Wellington, the agent and manager of the Silver Lake Company, of Newtonville, Mass. It is what rope-makers term *hard-laid;* that is, it is made very hard and compact in braiding and finishing. It was made in a single piece.

Dimensions, &c.

Maker's number	No. 3½	
Theoretical diameter	0.109375	inch.
Measured diameter	0.1	inch.
Length	800	yards.
Weight of line	7.625	pounds.
Weight of faking-box, B	24	pounds.
Weight of faking-box and line	31.625	pounds.

6.—*Time required for faking the different shot-lines.*

Date, 1877.		Shot-line.		Time of faking.	Faking-box, size.	Remarks.
Month.	Day.	Kind.	Length			
			Yds.	*Mins.*		
October....	12	Linen, No. 1	600	40	A	Line in coils taken up by winding around hand and elbow after firing.
	12	Hemp, No. 1	700	31	B	Line in coils taken up by winding around hand and elbow after firing.
	17	Hemp, No. 1.	700	28	B	Line in box; not carried out by shot.
	17	Hemp, No. 2.	700	28	B	Line in box; not carried out by shot.
	25	Hemp, No. 2.	700	40	B	Line on reel; assistant absent ten minutes.
	25	Linen, No. 2	600	21	A	Line on reel.
November	4	Hemp, No. 1.	700	28	B	Line in coils; wound up on arm.
	4	Hemp, No. 2.	700	27	B	Line in coils; wound up on arm.
	4	Linen, No. 1.	600	24	A	Line in coils; wound up on arm; piece broken off line.
	4	Linen, No. 2.	600	22	A	Line in coils; wound up on arm.
	22	Linen, No. 1.	600	20	A	Line in coils; wound up on arm; piece broken off line.
	22	Linen, No. 3	800	40	B	Line in coil as received from maker; interrupted by snarls.
	27	Linen, No. 3	750	28	B	Line in coils; wound on arm; fifty yards broken off.
	27	Hemp, No. 2	700	17	B	Line on reel.
	27	Linen, No. 2	600	22	A	Line on reel.

NOTE.—The writer did the faking in each instance. An assistant was required to press down the loops on the side of the box opposite to the faker, while a helper paid the line out of the coils or from the reel.—D. A. L.

SECTION II. LINES USED IN SECOND SERIES OF EXPERIMENTS.

1. *Experimental shot-lines.*

The braided shot-lines used in the second series of experiments were manufactured by the Silver Lake Company, of Newtonville, Mass.

The lines having the "ordinary finish" were procured by the Treasury Department, while those having the "water-proof finish" were furnished free of expense to the government by Mr. H. W. Wellington, of the firm of Wellington Bros., of Boston, Mass., who requested that they be tried at the same time with the other lines for the purpose of determining their relative merits.

The braiding of these lines is done by an ingenious machine, the invention of the late James Amiraux Bazin, of Canton, Norfolk County, Mass.

Referring to this process of making lines or ropes, the inventor states:

In the usual method of making ropes it is necessary to give the yarns a much harder twist than would be essential for binding the separate fibers together in order to compensate for what is taken out by the countertwist of the strand, thereby making it necessary, in laying these strands up into a rope, to give them a much harder twist than would otherwise be required, as it is the tendency of each strand to untwist that keeps them all firmly bound together; a hard-twisted rope necessarily requiring an equally hard twist in the strands, and thereby causing a constant strain upon all the fibers of which it is composed.

But where a soft and pliable rope is required, as the twist in the strands must be proportionally reduced, the strands will be liable to be thrown out of place and into kinks by careless usage.

To obviate this, ropes are sometimes made by braiding, which, though it prevents the strands from being thrown out of place, is still more objectionable, as the strands in this case run around spirally in contrary directions, and consequently a slight twisting of the rope either way will throw all the strain upon *one-half* the number of strands.

To overcome the above-mentioned difficulties is the object of my invention, which consists in combining the strands of any fibrous material by an interlocking twist, in

which the strands all take the same spiral form that they would have in a twisted rope of ordinary manufacture, and yet hold each other in place more effectually than can be done by braiding; this interlocking twist being formed by successively passing each strand around two others, so that each of the two so entwined shall, in its turn, entwine two others; and as the strands all maintain the same spiral form irrespective of the twists in each, there can be no unnecessary strain upon the fibers of which they are composed, while, under all circumstances, each strand will bear an equal amount of strain with all the others, and cannot possibly kink or become misplaced.

And my invention also consists in a new machine for forming the above-described interlocking twist, in which the spools that carry the strands are so actuated that two of the strands are held stationary while another is passing around them, thereby interlocking the strands as above described; and my invention furthermore consists in so arranging the mechanism as to permit of its being operated in either direction, as may be desired, according to the twist in the yarns of which the strands are composed.

The spool-carriers are always made to revolve in the same direction as the twist of the strands.

The inventor does not limit himself to any particular number of spools, provided only that the number shall be *a multiple of three.*

The number of "*travelers*" or spool-carriers employed in the machines for braiding the experimental lines for the United States Life-Saving Service were *nine* and *twelve*, depending upon the size of the lines.

2. *Materials.*

Linen and Italian hemp threads were used in the fabrication of the experimental lines.

The linen yarns were all furnished by the Smith & Dove Manufacturing Company, of Andover, Mass., and the Italian hemp yarns by the Boston Flax Mills.

In the process of braiding, a core of the same material is sometimes inserted.

The lines made on the twelve "*traveler*" machines are a little firmer, and the strands come to their places better with a core; but this is not indispensable, and, unless the yarn is harsh, the core is often omitted.

3. *Finishing.*

1. "Ordinary finish."

The lines are finished by being drawn rapidly twice through wheat starch.

The extra starch is wiped from the line by passing it through a piece of India rubber. It is then passed through a closely-fitting steel die, two inches in length. After drying a few moments, the cord is passed twice through another steel die, slightly smaller than the first. The latter operation gives the cord a polish and smooths the exterior.

2. "Water-proof finish."

The "water-proofed" lines are passed slowly through a hot mixture of linseed oil, bees-wax, and paraffine before receiving the usual finish.

The writer is indebted to Mr. James Tolman, of Boston, for the above details, as well as the following tabular statement in regard to the manufacture of braided lines:

4. *Materials, &c., used in the manufacture of shot-lines from Wellington Bros. & Co., agents for Silver Lake Company.*

Maker's number.*	Material.	Color.	Yarn.	Number of "travelers" in the braiding-machine.	Length.	Weight.
					Yds.	*Lbs.*
3½	Linen	Bleached	Andover, 3 cord, No. 16	9	700	7.
4	do	do	Andover, 5 cord, No. 16	9	700	12.5
4½	do	do	Andover, 5 cord, No. 10	9	700	13.
5	do	do	do	12	700	24.
6	do	Unbleached	Andover sail twine, 3 ply, 2 ends	12	600	31.5
7	do	do	Andover sail twine, 7 ply	12	600	33.
8	do	do	Andover sail twine, 3 ply, 3 ends	12	600	50.5
9	do	do	Andover sail twine, 3 ply, 4 ends	12	600	55.5
10	do	do	Andover sail twine, 3 ply, 5 ends	12	600	63.5
3½	Italian hemp	Natural	Wet spun, 6 cord	9	700	7.
4	do	do	Wet spun, 6 cord, 2 ply	9	700	13.
4½	do	do	Dry spun, 6 cord, 3 ply	9	700	15.5
5	do	do	Dry spun, 6 cord, 4 ply	12	700	26.
6	do	do	Dry spun, 6 cord, 5 ply	12	600	31.
7	do	do	Dry spun, 6 cord, 6 ply	12	600	38.
8	do	do	Dry spun, 6 cord, 7 ply	12	600	41.5
9	do	do	Dry spun, 6 cord, 8 ply	12	600	53.5
10	do	do	Dry spun, 6 cord, 10 ply	12	600	64.5
4	Dark linen	Unbleached	Andover, 3 ply, sail twine	9	700	14.5

* The maker's number indicates the diameter of the cord in thirty-seconds of an inch.

5. *Dimensions, weights, tests, &c.*

The following sets of tables give all the details in regard to these lines.

The two tables forming each set belong to the same group of lines. Lines Nos. 8, 9, and 10 of each group were not provided with faking-boxes, from motives of economy. The breaking weights and "stretch in six feet" are approximations only. The former was obtained by taking sections of each cord and carefully attaching them to two small grooved pulleys in such a way as to avoid cutting the cord at the knots. The length of cord between the knots was invariably six feet. One pulley was hung from a beam, and to a hook on the other was attached a large bucket. Lead weights were gradually placed in the bucket until the cord broke. The total load was carefully weighed in each instance.

Very small weights were used as the load neared the breaking weight or stress.

The *stretch* or increase of length of the cord was obtained by a vertical scale properly adjusted; an index or pointer attached to the side of the pulley on the lower end of the line assisted the observer in following the indications and taking the readings.

In other respects the tables are self-explanatory.

TABLE I.

A.

Experimental braided shot-lines of Italian hemp, made by Silver Lake Company, ordinary finish.

Number of lines.	Maker's number.	Material.	Length.		Diameter measured.		Weight.		Faking-box.		
			Yards.	Meters.	Inches.	Millimeters.	Pounds.	Kilograms.	Size.	Weight. Pounds.	Weight. Kilograms.
1	3½	Italian hemp	700	640.068	0.095	2.413	7.0	3.175	D	19.5	8.845
1	4	......do	700	640.068	.125	3.175	13.0	5.896	B	23.5	10.659
1	4½	......do	700	640.068	.145	3.683	15.5	7.030	B	24.0	10.886
1	5	......do	700	640.068	.190	4.826	26.0	11.793	C	33.0	14.968
1	6	Italian hemp, sash	600	548.63	.215	5.461	31.0	14.061	A	42.0	19.051
1	7	......do	600	548.63	.235	5.969	38.0	17.236	A	36.5	16.556
1	8	......do	600	548.63	.265	6.731	42.0	19.051	......	......	....
1	9	......do	600	548.63	.285	7.239	53.0	24.040	......	......	....
1	10	......do	600	548.63	.325	8.255	64.5	29.257	......	......	....

B.

Tensile strength and elongation of braided shot-lines, made of Italian hemp by Silver Lake Company, ordinary finish.

Number of lines.	Maker's number.	Material.	Breaking weight.		Stretch in six feet of line.	
			Pounds.	Kilograms.	Inches.	Millimeters.
1	3½	Italian hemp	70	31.751	9.0	228.60
1	4	......do	90	40.823	6.0	152.40
1	4½	......do	90	40.823	7.5	190.50
1	5	......do	252	114.306	11.0	279.39
1	6	Italian hemp, sash	300	136.079	12.0	304.79
1	7	......do	350	158.759	10.5	266.70
1	8	......do	467	211.829	14.0	355.59
1	9	......do	530	240.406	12.0	304.79
1	10	......do	673	305.270	11.5	292.09

TABLE II.

A.

Experimental shot-lines, linen, braided, made by Silver Lake Company, ordinary finish.

Number of lines.	Maker's number.	Material.	Length.		Diameter measured.		Weight.		Faking-box.		
			Yards.	Meters.	Inches.	Millimeters.	Pounds.	Kilograms.	Size.	Weight. Pounds.	Weight. Kilograms.
1	3½	Bleached linen	700	640.068	0.092	2.3368	7.0	3.175	D	18.0	8.164
1	4	......do	700	640.068	.127	3.226	12.5	5.670	B	24.0	10.886
1	4½	......do	700	640.068	.133	3.378	13.0	5.896	B	23.5	10.659
1	5	......do	700	640.068	.160	4.064	24.0	10.886	C	33.0	14.968
1	6	Unbleached linen, sash	600	548.63	.210	5.334	33.0	14.968	A	34.0	15.422
1	7	......do	600	548.63	.225	5.715	33.0	14.968	A	35.0	15.875
1	8	......do	600	548.63	.275	6.985	50.5	22.906	......	......	....
1	9	......do	600	548.63	.283	7.188	55.5	25.174	......	......	....
1	10	......do	600	548.63	.322	8.179	63.5	28.803	......	......	....

B.

Tensile strength and elongation of braided shot-lines, made of linen thread by Silver Lake Company, ordinary finish.

Number of lines.	Maker's number.	Material.	Breaking weight.		Stretch in six feet of line.	
			Pounds.	Kilograms.	Inches.	Millimeters.
1	3½	Bleached linen	102.0	46.266	6.0	152.40
1	4	......do	160.0	72.575	9.0	228.60
1	4½	......do	143.5	65.091	9.0	228.60
1	5	......do	245.0	111.131	8.5	215.90
1	6	Unbleached linen, sash	323.0	146.511	13.0	330.19
1	7	......do	391.0	177.356	12.5	317.49
1	8	......do	542.0	245.849	14.0	355.59
1	9	......do	683.0	309.806	13.0	330.19
1	10	......do	795.0	360.609	13.0	330.19

TABLE III.

A.

Experimental braided shot-lines of Italian hemp, made by Silver Lake Company, water-proof finish.

Number of lines.	Maker's number.	Material.	Length.		Diameter measured.		Weight.		Faking-box.		
										Weight.	
			Yards.	Meters.	Inches.	Millimeters.	Pounds.	Kilograms.	Size.	Pounds.	Kilograms.
1	3½	Italian hemp	700	640.068	0.100	2.540	8.0	3.628	D	18.0	8.164
1	4	......do	700	640.068	.120	3.048	14.0	6.350	B	23.0	10.432
1	4½	......do	700	640.068	.140	3.556	14.5	6.577	B	24.5	11.113
1	5	......do	700	640.068	.200	5.080	27.5	12.473	C	32.0	14.515
1	6	Italian hemp, sash	600	548.63	.210	5.334	27.0	12.247	A	36.0	16.329
1	7	......do	600	548.63	.225	5.715	37.5	17.009	A	35.5	16.102
1	8	......do	600	548.63	.274	6.985	42.0	19.051	......	......	....
1	9	......do	600	548.63	.295	7.493	53.0	24.040	......	......	....
1	10	......do	600	548.63	.320	8.128	55.5	25.174	......	......	....

B.

Tensile strength and elongation of braided shot-lines, made of Italian hemp by Silver Lake Company, water-proof finish.

Number of lines.	Maker's number.	Material.	Breaking weight.		Stretch in six feet of line.	
			Pounds.	Kilograms.	Inches.	Millimeters.
1	3½	Italian hemp	60	27.215	5.0	127.00
1	4	......do	110	49.896	5.0	127.00
1	4½	......do	157	71.215	6.0	152.40
1	5	......do	232	105.688	6.0	152.40
1	6	Italian hemp, sash	258	117.028	7.0	177.80
1	7	......do	320	145.151	8.0	203.20
1	8	......do	434	196.861	8.5	215.90
1	9	......do	476	215.912	11.0	279.39
1	10	......do	600	272.158	10.0	254.00

TABLE IV.

A.

Experimental braided linen shot-lines, made by Silver Lake Company, water-proof finish.

Number of lines.	Maker's number.	Material.	Length.		Diameter measured.		Weight.		Faking-box.		
										Weight.	
			Yards.	Meters.	Inches.	Millimeters.	Pounds.	Kilograms.	Size.	Pounds.	Kilograms.
1	3½	Linen, bleached	700	640.068	0.100	2.540	8.0	3.628	D	18.5	8.391
1	4	......do	700	640.068	.122	3.094	14.5	6.577	B	24.	10.886
1	4½	......do	700	640.068	.139	3.530	15.5	7.030	B	24.	10.886
1	5	......do	700	640.068	.175	4.445	24.0	10.886	C	31.5	14.288
1	6	Unbleached linen, sash	600	548.63	.225	5.715	31.5	14.288	A	36.5	16.556
1	7	......do	600	548.63	.225	5.715	33.5	15.195	A	35.5	16.102
1	8	......do	600	548.63	.280	7.112	51.0	23.133	......	......	....
1	9	......do	600	548.63	.285	7.239	54.0	24.494	......	......	....
1	10	......do	600	548.63	.335	8.509	70.0	31.751	......	......	....

B.

Tensile strength and elongation of braided shot-lines, made of linen thread by Silver Lake Company, water-proof finish.

Number of lines.	Maker's number.	Material.	Breaking weight.		Stretch in six feet of line.	
			Pounds.	Kilograms.	Inches.	Millimeters.
1	3½	Linen, bleached	91	41.277	5.	127.00
1	4	......do	137	62.142	8.	203.20
1	4½	......do	145	65.771	7.5	190.50
1	5	......do	268	121.563	7.5	190.50
1	6	Unbleached linen, sash	337	152.862	12.	304.79
1	7	......do	410	185.974	12.	304.79
1	8	......do	480	217.726	11.	279.39
1	9	......do	624	273.044	13.	330.19
1	10	......do	769	348.816	13.	330.19

TABLE V.

A.

Experimental braided shot-lines, unbleached linen thread, made by Silver Lake Company.

Number of lines.	Maker's number.	Material.	Length.		Diameter measured.		Weight.		Faking-box.		
										Weight.	
			Yards.	Meters.	Inches.	Millimeters.	Pounds.	Kilograms.	Size.	Pounds.	Kilograms.
1	4	Unbleached linen	700	640.068	0.127	3.226	14.5	6.577	B	23.5	10.659
1	4	Unbleached linen, W. P.	700	640.068	0.125	3.175	16.5	7.484	B	25.0	11.340

NOTE.—These lines are invoiced as "Dark linen."

B.

Tensile strength and elongation of braided shot-lines, made of unbleached linen thread by the Silver Lake Company.

Number of lines.	Maker's number.	Material.	Breaking weight.		Stretch in six feet of line.		Remarks.
			Pounds.	Kilograms.	Inches.	Millimeters.	
1	4	Unbleached linen	172	78.018	7	177.8	Ordinary finish.
1	4	Unbleached linen, W. P.	145	65.771	9.5	241.3	Water-proof finish.

III. Reel for shot-lines.

(Plate XXXV.)

It was found necessary during the experimental firing to have some method of taking up the lines rapidly, and, at the same time, one that would keep them from becoming entangled.

A light reel was designed for this purpose which answered all the requirements. This simple contrivance consists of a frame, reel, and crank of wood, and of two wire pins.

The frame is dovetailed together, and has four small D-rings attached to it by bits of leather. These rings engage with the snap-hooks of the carrying-braces. The reel is composed of an arbor, carrying cross-pieces at each end. The arbor is retained in the frame by the wire pins.

A strip of leather passes over the extremities of the cross-pieces at each end to keep the radial arms from catching in the line when winding it up.

Dimensions and details of construction may be seen in the drawings. Weight of reel complete, 8 pounds.

IV. Carrying-braces for reel.

(Plate XXXVI.)

These braces were made to carry the reel and frame.

They consist of a waist-belt and a set of light cross-belts or braces, with snap-hooks for attaching the reel-frame.

The operator walks along, winding up the line as he proceeds, thus preserving the line from injuries which would result from dragging it through the sand, over rocks and bushes. (See plate for details.) Weight, 1 pound.

CHAPTER VII.

FAKING-BOXES.

These boxes are designed for placing the shot-lines in position for firing. The lines are stowed away in the boxes in a peculiar manner, called "faking." The method is one adopted by the English for the stowage of their rocket-lines.

I. FAKING-BOX A (large).

(Plate XXXI.)

1. *Description.*

		Inches.	Centim'rs.
External dimensions	Length	36.0	=91.438
	Width	19.9	=50.545
	Depth	12.75	=32.384
Internal dimensions	Length	34.9	=88.644
	Width	18.8	=47.751
	Depth	12.2	=30.937

2. *Weight.*

	Lbs.	Kilos.
Average weight, empty	35	=15.874
Average weight, with "braided linen line, Silver Lake Co., No. 6," about	66.5	=30.163
Average weight, with "braided linen line No. 7"	68	=30.843

3. *Material.*

This box is made of well-seasoned white pine. The faking-pins are made of hickory, and the frame for these pins of ash.

4. *Nomenclature and dimensions.*

		Inches.	Centim'rs.
1 top	Length	36.0	=91.438
	Width	19.9	=50.545
	Thickness	.55	= 1.397
2 side pieces, same size	Length	36.0	=91.438
	Width	12.2	=30.937
	Thickness	.55	= 1.397
2 end pieces, same size	Length	19.9	=50.545
	Width	12.2	=30.937
	Thickness	.55	= 1.397
1 "false bottom"	Length	34.6	=87.882
	Width	18.6	=47.243
	Thickness	.55	= 1.397

Frame for faking-pins.

2 side pieces, same size	Length	38.0	=96.519
	Width	3.75	= 9.525
	Thickness	.9	= 2.286
2 end pieces, same size	Length	21.0	=53.339
	Width	4.2	=10.668
	Thickness	.9	= 2.286

Faking-pins.

			Inches.	Centim'rs.
48 pins, same size...	Total length		12.4	= 31.495
	Body.....	Length	11.5	= 29.209
		Greatest diameter	1.0	= 2.540
		Least diameter	.35	= .889
	Screw	Length	.9	= 2.286
		Diameter	.7	= 1.778
2 cleats for rope handles, same size.		Length	6.2	= 15.748
		Width	2.0	= 5.080
		Thickness	1.4	= 3.556
2 handles, hemp rope		Length	18.0	= 45.719
		Diameter	.5	= 1.270

2 hasps, metal, for fastening box to frame.

5. *Construction.*

The sides and ends are dovetailed together at the corners. The top is nailed to the ends and sides with one-and-a-half-inch and six-penny finishing nails. The cleats carrying the rope-handles are fastened to the box, one at each end, by four small screws.

The "false bottom" has a row of holes, 1″.2 (3.05 centimeters) in diameter around the perimeter. Along the sides and ends the centers of these holes are situated 1″.3 (3.3 centimeters) from the edges. The distance between the centers of any two consecutive holes is 2″ (5.08 centimeters).

The sides and ends of the frame for the faking-pins are put together with mortises and tenons.

Along the sides, the centers of the screw-holes for the faking-pins are placed 2″.5 (6.35 centimeters) from the outer edges; the centers of these holes are 3″ (7.62 centimeters) from the outer edges along the ends of the frame.

The distance between the centers of any two consecutive screw-holes is 2″ (5.08 centimeters).

The holes are bored and tapped to form a coarse-threaded female screw.

There are seventeen holes on each side and seven at each end of both the bottom and the frame, making forty-eight holes in each.

The faking-pins are turned in a lathe from pieces of hickory of the proper length. The body is a frustum of a cone. The upper end is slightly rounded off. A coarse, cylindrical screw is cut upon the lower end.

A metallic hasp which passes over a button attached to the end of the box is fastened to each end of the frame, and serves to hold the frame and box together in transportation and handling.

In the boxes usually made for the United States Life-Saving Service an iron staple takes the place of the hasp, and a staple and hook of the same material supplants the button; but they form a very insecure fastening. In handling the boxes the hooks are apt to become disengaged and let the frame and line fall, thus increasing the chances of entangling the latter.

The outside of the box is painted a deep blue, with narrow marginal stripes of red.

6. *Marks.*

The letters "U. S. L. S. S." are painted in *white* upon the top.

II. Faking-box B (small).

(Plate XXXII.)

1. *Description.*

		Inches.	Centim'rs.
External dimensions	Length	24.0	= 60.959
	Width	16.0	= 40.639
	Depth	12.8	= 32.511
Internal dimensions	Length	22.8	= 57.911
	Width	14.8	= 37.591
	Depth	12.2	= 30.937

2. *Weight.*

	Lbs.	Kilos.
Average weight, empty	24	= 10.886
Average weight, with "linen line No. 4," about	36.5	= 16.556
Average weight, with "linen line No. 4½," about	37	= 16.782

3. *Materials.*

The box and "false bottom" are made of white pine; the faking-pins of hickory; the frame of ash; all well seasoned.

4. *Nomenclature and dimensions.*

		Inches.	Centim'rs.
1 top	Length	24.0	= 60.959
	Width	16.0	= 40.639
	Thickness	.6	= 1.524
2 side pieces, same size	Length	24.0	= 60.959
	Width	12.2	= 30.937
	Thickness	.6	= 1.524
2 end pieces, same size	Length	16.0	= 40.639
	Width	12.2	= 30.937
	Thickness	.6	= 1.524
1 "false bottom"	Length	22.6	= 57.403
	Width	14.6	= 37.083
	Thickness	.6	= 1.524

Frame for faking-pins.

2 side pieces, same size	Length	26.0	= 66.039
	Width	3.7	= 9.398
	Thickness	.9	= 2.286
2 end pieces, same size	Length	17.0	= 43.179
	Width	4.3	= 10.922
	Thickness	.9	= 2.286

Faking-pins.

32 pins, same size	Total length		12.4	= 31.495
	Body	Length	11.5	= 29.209
		Greatest diameter	1.0	= 2.540
		Least diameter	.35	= .889
	Screw	Length	.9	= 2.286
		Diameter	.7	= 1.778

		Inches.	Centim'rs.
2 cleats for rope handles, same size	Length	6.2	= 15.748
	Width	2.0	= 5.080
	Thickness	1.4	= 3.556
2 handles, hemp rope	Length	18.0	= 45.719
	Diameter	.5	= 1.270

2 hasps, metal, for fastening box to frame.

5. *Construction.*

The general construction of this box differs from the one given above in the following particulars only, viz:

1. In having 32 instead of 48 faking-pins.
2. In having 32 instead of 48 holes in bottom.
3. In having 32 instead of 48 screw holes in frame.

The distances of the holes, etc., from the outer edge of the bottom and of the frame, and from each other, are identical in the two cases. The painting and marks are also the same.

NOTE.—The two sizes of faking-boxes given above are issued to life-saving stations at the present time, and correspond to the two sizes of shot-lines issued.

III. FAKING-BOX C (large, square).

(Plate XXXIII.)

1. *Description.*

		Inches.	Centim'rs.
External dimensions	Length	24.0	= 60.959
	Width	24.0	= 60.959
	Depth	12.8	= 32.511
Internal dimensions	Length	22.9	= 58.165
	Width	22.9	= 58.165
	Depth	12.3	= 31.241

2. *Weight.*

	Lbs.	Kilos.
Average weight, empty	33	= 14.968
Average weight, with "linen line No. 5," about	57	= 25.854

3. *Materials.*

The materials for this box are the same as those used for the preceding boxes.

4. *Nomenclature and dimensions.*

		Inches.	Centim'rs.
1 top	Length	24.0	= 60.959
	Width	24.0	= 60.959
	Thickness	.5	= 1.270
2 side pieces, same size	Length	24.0	= 60.959
	Width	12.3	= 31.241
	Thickness	.55	= 1.397
2 end pieces, same size	Length	24.0	= 60.959
	Width	12.3	= 31.241
	Thickness	.55	= 1.397
1 "false bottom"	Length	22.6	= 57.40
	Width	22.6	= 57.[illegible] .3
	Thickness	.6	= 1.[illegible] .03
			.624

Frame for faking-pins.

		Inches.	Centim'rs.
2 side pieces, same size	Length	25.8	= 65.531
	Width	3.7	= 9.398
	Thickness	.9	= 2.286
2 end pieces, same size	Length	24.75	= 62.86
	Width	4.3	= 10.92
	Thickness	.9	= 2.286

Faking-pins.

40 pins, same size	Total length		12.4	= 31.495
	Body	Length	11.5	= 29.209
		Greatest diameter	1.0	= 2.540
		Least diameter	.35	= .889
	Screw	Length	.9	= 2.286
		Diameter	.7	= 1.778
2 cleats for rope handles, same size		Length	6.2	= 15.748
		Width	2.0	= 5.080
		Thickness	1.4	= 3.556
2 handles, hemp rope		Length	18.0	= 45.719
		Diameter	.5	= 1.270

2 hasps, metal, for fastening box to frame.

IV. Faking-box D (small, square).

(Plate XXXIV.)

1. *Description.*

		Inches.	Centim'rs.
External dimensions	Length	16.0	= 40.639
	Width	16.0	= 40.639
	Depth	12.8	= 32.511
Internal dimensions	Length	14.9	= 37.845
	Width	14.9	= 37.845
	Depth	12.3	= 31.241

2. *Weights.*

	Lbs.	Kilos.
Average weight, empty	18	= 8.164
Average weight, with "linen line No. 3½," about	26	= 11.792

3. *Materials.*

The materials for this box do not differ from those of the preceding boxes.

Nomenclature and dimensions.

		Inches.	Centim'rs.
1 top	Length	16.0	= 40.639
	Width	16.0	= 40.639
	Thickness	.5	= 1.270
2 side pieces, same size	Length	16.0	= 40.639
	Width	12.3	= 31.241
	Thickness	.55	= 1.397
2 end pieces, same size	Length	16.0	= 40.639
	Width	12.3	= 31.241
	Thickness	.55	= 1.397

		Inches.		Centim'rs.
1 "false bottom"	Length	14.55	=	36.956
	Width	14.55	=	36.956
	Thickness	.6	=	4.064

Frame for faking-pins.

		Inches.		Centim'rs.
2 side pieces, same size	Length	18.0	=	45.719
	Width	3.7	=	9.398
	Thickness	.9	=	2.286
2 end pieces, same size	Length	16.9	=	42.925
	Width	4.35	=	11.049
	Thickness	.9	=	2.236

Faking-pins.

			Inches.		Centim'rs.
24 pins, same size	Total length		12.4	=	31.495
	Body	Length	11.5	=	29.209
		Greatest diameter	1.0	=	2.540
		Least diameter	.35	=	.889
	Screw	Length	.9	=	2.286
		Diameter	.7	=	1.778
2 cleats for rope handles, same size		Length	6.2	=	15.748
		Width	2.0	=	5.080
		Thickness	1.4	=	3.556
2 handles, hemp rope		Length	18.0	=	45.719
		Diameter	.5	=	1.270

2 hasps, metal, for fastening box to frame.

NOTE.—The square faking-boxes C and D do not differ materially in construction from boxes A and B. They are experimental boxes.

PART III.

RECORD OF EXPERIMENTS.

The experiments are divided into two series; the first series comprising those made at Springfield, Mass., in the autumn of 1877; the second, those made at Sandy Hook, N. J., in the spring of 1878.

CHAPTER I.

FIRING-GROUNDS.

I. FIRING-GROUND AT SPRINGFIELD, MASS.

(Plate XXXVII.)

Considerable difficulty was experienced in finding a suitable firing-ground in convenient proximity to the National Armory. The grounds possessed by the United States Government afforded too limited a range to be of any practical utility. The government for its own purposes used ranges over water in experimental firing; but though the ultimate object of the present trials was to determine the best means of throwing lines over an intervening space of water, it was especially undesirable during these trials to have such an inconvenient obstruction between the initial and objective points of the firing.

Some of the chief requisites of a good firing-ground for making experiments in throwing lines are:

1. That it should present an adequate range.
2. That it should be nearly level.
3. That there should be no obstacles to interfere with the attainment of a good view of the shot and line throughout the trajectory, nor with taking up the line after firing. This condition rejects a range over water not only on account of wetting the line, thereby increasing its weight and rendering the result of the subsequent shot incomparable with one made with the dry line, but also by increasing the physical difficulties of taking up the line and replacing it in the faking-box.

It also rejects ground covered with briars or other prickly plants or shrubs whose prickles penetrate and break off in the line when it is drawn through them, thus rendering the handling of the line both difficult and painful.

4. That the extent of the range should be great enough to enable the observer to note the point of fall of those shot that break the line and pass far beyond the limits which they would attain if the line remained intact, in order that the shot may be easily recovered for subsequent use.
5. That human habitations should not be in or near the plane of fire.

After some time spent in prospecting for a spot suited to the object in view, one was selected about one mile from the city of Springfield, Mass., but still within the city limits. It consisted of two strips of meadow-land nearly level for about 700 yards; the extremity of the range

farthest from the gun having the greater elevation. The ground presented a very clear range of 687 yards between the two tracts of timber land at its extremities.

The disadvantages were, that the firing had to be done over a much-traveled road, that the land closely adjacent was often occupied by laborers, that the nearness of the city enabled many idlers, especially boys, to congregate in the vicinity of the plane of fire. The delays and annoyances due to these causes were many and oftentimes very troublesome. All the appurtenances of the range had to be set up and removed at each visit to prevent their wanton destruction by tramps or thoughtless boys.

No difficulty was experienced in obtaining the necessary permission from the municipal authorities to fire within the city limits and over the roadway. They merely required that sentinels should be stationed on the road to warn passers by, in order to prevent accidents.

The land occupied was owned by Mr. E. W. Bond, president of the Massachusetts Mutual Life Insurance Company, and Mr. James Kirkham, president of the First National Bank of Springfield, both of whom very kindly and generously allowed it to be used without asking for any compensation.

At the firing point a gun platform was constructed to avoid the tearing up of the ground due to the recoil in continued firing.

This platform was 8 feet long and 6 feet wide, made of 2-inch deck plank spiked down upon 4 sleepers. The sleepers were 8 feet long, with a cross-section of 10 inches square, and were bedded in the ground flush with the surface. Immediately in front of the center of the platform was driven the initial stake from which the range was measured. The muzzle of the piece was placed directly over this stake in firing. From this point the range was laid off by means of a tape-line 100 feet long; and a stake, with its distance in yards from the origin marked upon it, was driven down at 100 yards, and at each additional hundred yards from the initial point. Intermediate stakes were driven at intervals of 25 yards between those which designated the 100-yard points. This arrangement greatly facilitated the measurement of the ranges of the shot.

Later a second range was laid out from the same origin, but so inclined as to clear the point of the woods, in which several shot had been lost by the breaking of the lines. This range was marked at each hundred yards by an appropriately-numbered stake.

The ranges were remeasured, to preclude any possibility of error.

To the right and rear of the gun platform was erected a shelter 7 feet long and 6 feet high, made of 10-inch timber, to screen the firing party when testing new guns with heavy charges. Every precaution was taken to prevent accidents. The guns were always fired with a lanyard and service primer. When firing, range flags were placed at the 300, 400, and 500-yard stakes, to mark the line of fire. In *every case* the gun was pointed so as to bring the plane of fire to coincide with the line of flagstaves. Twenty-five yards to the right of the 200-yard stake was placed a Casella anemometer, to measure the approximate surface velocity of the wind. This instrument was placed a little over five feet from the ground. It occupied a clear space, removed from any obstructions that would modify the velocity of the surface current of air. The direction of the wind with reference to the line of fire was estimated from the position assumed by a vane five feet long, situated at the same spot as the anemometer.

General method of firing.

The practice usually observed in firing was as follows:

1. To set up and align the range flags.
2. To place the anemometer in position and take the initial reading.
3. To place the faking-box containing the line in position for firing.
4. To point the gun so that the vertical plane through its axis would coincide with the line of flags as closely as possible.
5. To charge the piece with a cartridge containing the powder.
6. To attach the line to the shot and insert it in the piece.
7. To give the proper elevation.
8. To prick the cartridge and insert the friction primer.
9. To fire the gun.
10. To take the reading of the anemometer.
11. To measure the range. The distance from the nearest stake to the point where the shot fell is measured with a pole 10 feet long and then reduced to yards, and added *algebraically* to the number of yards on the stake.
12. The deviation of the shot to the right or left of the line of fire is measured in feet with the same pole.
13. The bowing or drift of the slack of the line from the plane of fire at the 300-yard stake is measured.

II.—Firing-ground at Sandy Hook, N. J.

The second series of experiments were conducted at the ordnance "proving-ground" at Sandy Hook, N. J.

Permission to use these grounds was granted by General S. V. Benét, Chief of Ordnance, and Col. S. Crispin, constructor of ordnance, United States Army.

A range was laid out along the sandy beach, carefully measured, and marked by stakes, as in the preceding instance at Springfield, Mass.

Range-flags were used to indicate the plane of fire.

A gun-platform 13 feet square was placed at the firing-point, which, though it allowed the gun and carriage to recoil more in firing, was a necessity where continued experiments are carried on in the yielding sand.

A Casella anemometer was mounted on a staff 5 feet high and placed about 20 yards to the right of the 200-yard stake, for the purpose of obtaining the velocity of the wind at the surface of the ground.

A vane was placed at the same point, to determine the direction of the wind with reference to the plane of fire.

The velocity of the wind at an altitude of about 50 feet above the surface of the ground was taken, whenever possible, at the office of the Ordnance Board, a short distance in rear of the firing point.

On a subsequent page are given the velocities of the wind during the hours of experimental firing, as indicated by the self-registering apparatus in the office of the signal-service observer.

The two instruments last referred to are Robinson anemometers, and are by no means so delicate in their indications as the Casella air-meter used for the surface velocities.

In the tables giving the results of the firings, the long arrow, running the whole length of the column, marked "Wind direction," represents the intersection of the plane of fire with the surface of the ground and the direction in which the guns were pointed.

The short arrows indicate the direction of the wind with reference to this line.

—— Synoptical transcript of notes from the firing record.

NGFIELD, MASS.

ronze (converted).

ecoil of gun.

	Material.
d	Linen No. 1
	do
	Italian hemp No. 1
	Linen No. 1
d	do
	do
	do
	Italian hemp No. 1
	do
	do
	Linen No. 1
	Italian hemp No. 1
ek of bed	do
d	do
one feet	Linen No. 2
	Italian hemp No. 2
d	do
broke cheek of bed.	Linen No. 2
d	Italian hemp No. 2
	Linen No. 1

rds reduced to yards and decimal parts of a y

General method of firing.

1. *Synoptical transcript of notes from the firing record.*

3 INCH M. L. RIFLED MORTAR—BRONZE.

Date.	No. of round.	
1877. Sept. 22.	1	Rifle projectile.—Gas entered axial cavity notwithstanding sabot, and blew the cap off; cutting the retaining-screw entirely off, carrying the knot, rubber tube, and washer out at the front end of the shot. When the resistance of the line drew the rubber tube and knot back, the former caught on the forward end of the shot, introverting a portion of the tube and cutting off the line. About 20 yards of line carried out. Rubber tube found about 150 yards in front of gun. A good line-shot, ranging 723 yards and striking a tree, 40 feet from the ground. Projectile recovered.
	2	Rifle projectile.—The cap was not blown off, nor was any trace of gas found in the axial cavity. The shot and line were recovered; the rotation of the shot due to the rifled motion twisted the line badly. The line assumed a spiral fusiform shape in rear of the projectile; the spirals near the shot being very small and increasing in amplitude with their distance in rear of it, until a point within about 50 yards of the faking-box was reached, from which point to the box the amplitude of the spirals decreased. This tapering of the spirals in rear of the shot increased greatly the resistance of the air and diminished the range.
	3	Rifle projectile.—Line carried out 25 or 30 yards; end appeared as if burned off; shot lost. One sabot recovered.
27.	4	Rifle projectile.—Copper-wire rope interposed between shot and line, broke. Forty yards of line carried out. Gas entered axial cavity and started the brazing of the cap. Projectile rotated about its shorter axis and struck upon its side.
	5	Rifle projectile.—The cap being lost the line was knotted over a lead washer and inserted in the gun point first, with two sabots to rest upon and prevent the gas burning off the knot. The shot was fired base first, took the rifled motion, and when it felt the strain upon the line it reversed, but retained the rifled motion and undulated up and down in the trajectory. The line was twisted as before.
	6	Rifle projectile.—This shot was placed in the gun like the preceding one and fired base first, but when it reversed it did not proceed point foremost, but continued to rotate about its shorter axis. The rotation of the shot twisted the line.
Oct. 6.	7	Smooth-bore projectile.—The bowing or drift of the shot-line from the line of fire at the 300-yard stake was 129 feet to the right. The shot kept point foremost after reversing and the resistance of the line kept it so.
	8	Rifle projectile.—Used one wooden and one Cordes sabot. Gas penetrated axial cavity, burning off the line, which was found to be still burning when examined. Shot lost. Range unknown. Action in trajectory unknown.
	9	Smooth-bore projectile.—This shot rotated about its shorter axis during its whole flight; the line did not experience resistance enough to keep the shot point first. Wind directly across line of fire, velocity about 6.37 miles per hour. The line bowed 226 feet to the right at the 300-yard stake.
10.	10	Rifle projectile.—The shot was fired base first. The base was turned off, forming a frustum of a cone, and the longitudinal groove for the line (along the side of the shot) was partially filled with lead. The escape of gas in firing cut out lead. The shot rotated about its shorter axis in the first part of the trajectory and kept point first during the latter part of its flight. Shot penetrated two feet into

1. *Synoptical transcript of notes from the firing record*—Continued.

3-INCH M. L. RIFLED MORTAR—BRONZE—Continued.

Date.	No. of round.	
1877.		the ground in falling. Line twisted and lay in loose coils in the vicinity of the point where the shot struck. The line bowed 68 feet to right of 300-yard stake.
Oct. 10	11	Smooth-bore projectile.—Line ran out beautifully. Bowing of line, 14 feet to right of 300-yard stake. Escape of gas through rifles diminishes range.
	12	Smooth-bore projectile.—Bowing of line, 33 feet to left of 300-yard stake. Velocity of wind probably greater than given, as the interval between readings in this case was 63 minutes, and the wind was increasing all the time. Escape of gas through the rifles affected the range.
13	13, 14	Smooth-bore projectiles.—Line burnt off in each case and shot lost. Range uncertain, probably over 800 yards. Both shot rotated about shorter axis. Faking-box placed 9 feet to left of platform on windward side. Line burned off in loop in each case; end of line on fire when examined. The length of the powder-charge was such that it greatly increased the gas-escape through the grooves.
24	15	Smooth-bore projectile.—Bowing of line, 13 feet to right at the 300-yard stake. The line was all carried out and the end dragged 115 feet from the box towards the front. Shot penetrated earth 18 inches. Reading of anemometer uncertain, not properly adjusted; but result varies but little from the truth.
	16	Smooth-bore, projectile. Bowing of line, 9.5 feet to left at 300-yard stake. The line was all carried out, the loose end being dragged to the front a distance of 128 feet. Shot buried 2 feet in the ground. Projectile rotated about its shorter axis three or four times in the first part of the trajectory. Wind-velocity 5.2 miles per hour.
Nov. 3	17	Smooth-bore projectile.—The shank broke off close to base of shot. It broke when the shot reversed and brought the strain upon the shank, which accidentally had been made of steel instead of wrought iron. Shot lost. About 100 yards of line carried out.
	18	Smooth-bore projectile.—Shot with very long shank (10 inches). Faking-box to left of gun-platform. Bowing of line, about 200 feet to right at 300-yard stake. Wind, 10.864 miles per hour.
12	19	Smooth-bore projectile.—Shot carried away 75.5 feet of hemp line, which probably broke at or near a spot that had been partially cut through previously by whipping against edges of box. Shot recovered. Range over 900 yards.
	20	Smooth-bore projectile.—Bowing, 70 feet to right at 300-yard stake. Shot had 10-inch shank.

1. *Synoptical transcript of notes from the firing record—Continued.*

GFIELD, MASS.

to a caliber of 2 inches.

	Length.	
terial.	Yards.	Meters.
emp No. 1..	700	640 +
....	700	640 +
). 1.........	600	548 +
....	600	548 +
emp No. 2..	700	640 +
emp No. 1..	700	640 +
....	700	640 +
....	700	640 +
....	700	640 +
emp No. 2..	700	640 +
....	700	640 +
emp No. 1..	700	640 +
....	700	640 +
emp No. 2..	700	640 +
....	700	640 +
o. 2	600	548 +
emp No. 2..	700	640 +
....	700	640 +
o. 1.........	600	548 +

such great initial velocity as this shot. The sabot (Cordes) was a failure, the gas passing it and entering the axial cavity; the pressure of the gas inside the shot was so great that the head was blown off and lost. A portion of the shot and sabot were recovered.

1. *Synoptical transcript of notes from the firing record*—Continued.

1. *Synoptical transcript of notes from the firing record—Continued.*

GUN A.—2 INCHES CALIBER.

Date.	No. of round.	
1877.		
Nov. 3	1	Line broke. Shot carried away 22¾ yards of line. The detached portion of the line was partially cut through in two places; one cut or break was 4¾ yards from loose end (or 18 yards from projectile), and extended half-way through the line; the other was a slight cut nearer the shot and not so deep. A few yards of the line was faked upon the ground in about 18-inch lengths. The vibrations of the line were violent, whipping badly across the edges of the box and cutting off the line. Projectile recovered.
	2	The bowing of the line at the 300-yard stake was 119 feet, and was a little greater at the 400-yard stake. Velocity of wind, 9.71+ miles per hour.
	3	Broke linen line No. 1. Shot lost.
	4	Bowing of the line 136 feet to the right of the 300-yard stake. Velocity of the wind, 10.2 miles per hour. Line knotted badly by some of the fakes slipping under others. The line was cut half off about 20 yards from the projectile by striking the edge of the faking-box. The vibrations of the line were so violent as to split the end of the box 4 inches from the top.
	5	Line burnt off by flames of gas escaping around shot through the windage. Burnt off at point of attachment to shot. Projectile lost. Range over 1,000 yards. Faking-box placed 15 yards in front of the gun.
7	6	Shot turned over and over about its shorter axis.
	7	Projectile rotated three or four times about its shorter axis in a plane nearly horizontal and then oscillated up and down during the remainder of its flight, keeping its head or point to the front.
	8	Wind, light and variable, changing direction often.
	9	A knot in the line from the fakes slipping under each other and looping.
	10	Bowing of line, 24 feet to the left at the 300-yard stake. The bore of the gun noticed to be slightly enlarged.
	11	Bowing of the line, 22 feet to the left at the 300-yard stake.
	12	Bowing of the line, 54 feet to the left at the 300-yard stake.
	13	Bowing of the line, 67 feet to the left at the 300-yard stake.
	14	Italian hemp line No. 2. Broke near box. No line carried out. Probable range over 750 yards. Projectile rotating about shorter axis.
	15	Same remark as preceding shot.
	16	Linen line No. 2. Bowing of line, 50 feet to the left at the 300-yard stake.
12	17	Bowing of line, 23 feet to the right at the 300-yard stake. Elevation of piece too great. Trajectory too high, requiring more line than was necessary for the range attained. The resistance of the air on the falling line was so great that, when descending, the projectile appeared to fall almost vertically for quite a distance.
	18	Line broke. Projectile lost.
	19	Line (linen No. 1) broke. Initial velocity of projectile too great. The rapidity of vibration of the rope in running from the faking-box was so violent as to knock out the upper part (4″ wide) of one end of the box, though the corners were dovetailed together. The fakes in the rope were too long to be used with projectiles having such great initial velocity as this shot. The sabot (Cordes) was a failure, the gas passing it and entering the axial cavity; the pressure of the gas inside the shot was so great that the head was blown off and lost. A portion of the shot and sabot were recovered.

1. *Synoptical transcript of notes from the firing record.*

GUN A.—2.5 INCHES CALIBER.

PRINGFI

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Date.	
1877.	
	Itali
Nov. 21	Itali
21	.....
21	.....
21	Line
21	.....
2	Line
2	Line
2	.....
2	.....
	.....
	Line
	.....
	Itali
	Line
	Itali

as if suspended by the line. After the projectile had passed over about one-half of its descent, the light line becoming slack, was

1. *Synoptical transcript of notes from the firing record.*

GUN A.—2.5 INCHES CALIBER.

Date.	No. of round.	
1877.		
Nov. 21	1	No remarks.
	2	Line broke; shot carried away 90 feet of line; shot recovered. Range, over 900 yards.
	3	Forty-six feet of linen line (No. 1, diameter 0''.22) tied, one end to shot and the other to the Italian hemp line No. 1, to receive the first shock of discharge. When fired the knot came loose with a noise like the explosion of a friction primer.
	4	The bowing or drift of the line from the line of fire was 110 feet at the 300-yard stake.
	5	Linen line No. 1 cut off at 105 feet from the shot by whipping against the edge of a slight notch in the side of the faking-box; shot and attached portion of line recovered. Range over 900 yards.
	6	Bowing of line at 300-yard stake, 71 feet.
	7	Bowing of line at 300-yard stake, 84 feet.
22	8	New braided line, "No. 3¼ linen, bleached." Deviation of line from plane of fire, 75 feet at 300-yard stake and 86 feet at 400-yard stake. About 775 yards of line carried out of box. Six knots found in line; These were small loops formed by some of the fakes slipping under others and being drawn into a knot by the rapid vibrations of the line. The projectile penetrated two feet into the ground. The gun and bed turned upside down after sliding from the platform, due to the surface of the latter being 6 inches above the ground in rear of it.
	9	Line broke; shot carried away 27.5 yards of line. A small knot found 20 yards from projectile. The range was about 1,000 yards, deviating slightly to the left of the line of fire. The shot struck a tree, breaking the shank off at the beginning of the screw-thread; both shot and line recovered. The shot and attached piece of line described an undulatory path, in a vertical plane.
	10	Line broke; shot carried away 21 yards of line. The line (the detached portion) was found to be nearly cut through at 13 yards distance from the shot, probably due to a knot which pulled out before the line was severed; a small knot was found 20 yards from shot. The range was about 40 yards greater than the preceding shot; the deviation was slightly to the right; the projectile rotated horizontally about its shorter axis.
		In this and the preceding case the frayed ends of the broken line were 1''.5 long, appearing as if combed. This length (1''.5) was greater than any hitherto found to occur with any line used; the braided lines having usually broken sharply off without leaving the ends frayed more than a fraction of an inch. Several knots were also found in different parts of the line. The faking-box testified to the violent vibrations of the line in running out, by the indentations made in the edges, sides, and ends of the box by the line. From these facts it would appear probable that some of the fakes caught each other and looped, and were drawn sharply against or across the edge of the box, forming a knot whose resistance was sufficient to cause the severance of the line.
27	11	Line drifted 353 feet to left of plane of fire at 400-yard stake. All the line (751 yards) was carried out, together with part of piece of old line (0''.22 in diameter) which had been attached to the shot-line. The shot in the last portion of the trajectory fell in a line closely approaching a vertical; in fact, it appeared from the firing-point as if suspended by the line. After the projectile had passed over about one-half of its descent, the light line becoming slack, was

1. *Synoptical transcript of notes from the firing record*—Continued.

GUN A.—2.5 INCHES CALIBER—Continued.

Date.	No. of round.	
1877.		drifted off by the wind, whose velocity near the upper part of the trajectory was much greater than that near the surface of the ground. Six small knots or loops were found in the line. The great bowing of the line was due to its lightness, the high angle of elevation, the velocity of the wind high above the surface of the plain, and the fact that when the shot was descending there was little or no longitudinal strain.
Nov. 27	12	Line broke; shot carried away 37 yards of linen line No. 2; both recovered. Faking-box is too long for use with this initial velocity for projectile. The vibrations of the line were very violent; the box showed indentations where the faked loops had been sunk into the wood by the whipping.
	13	With six ounces of Hazard musket-powder the base of the projectile (L. 3), experimental No. 11, was flush with the face of the muzzle.
	14	Shot carried away 28 yards of line (Italian hemp No. 2).
	15	Linen line No. 2: The line bowed 65 feet to the left of the 300-yard stake. This line was faked in the small boxes "B," filling two of them. By placing in this size box the amplitude of the lateral vibrations is much diminished.
	16	Italian hemp line No. 2: The bowing measured at the 300-yard stake was 124 feet to the left; angle of elevation too great for the wind that was blowing.

D.

es.

on.]

Length.	
Yards.	Meters.
700	640 +
600	548 +
600	548 +
600	548 +
600	548 +
600	548 +
600	548 +
700	640 +
600	548 +
600	548 +
600	548 +
600	548 +
600	548 +
700	640 +
600	548 +
700	640 +
600	548 +
600	548 +
600	548 +
700	640 +
700	640 +
600	548 +
600	548 +
700	640 +
700	640 +
700	640 +
700	640 +
700	640 +

W. P. = Water-p

1. *Synoptical transcript of notes from the firing record.*

GUN A.—CALIBER, 3 INCHES.

Date.	No. of round.	
1878. May 14	1	Italian hemp line No. 4¼ emptied into a pine packing-box before firing. Lateral vibrations of line sufficient to loosen the nails in both ends of box. End of line found in crack between end and side of box. The line was probably cut off by being drawn violently across sharp corners and through the crack—uncertain, may have been broken. Shot ranged 850 yards, carrying 27 yards of line with it.
	2	Base of projectile flush with the face of muzzle. Vibrations of line knocked the bottom and end out of the faking-box (A).
	3	Line (hemp No. 7) broken squarely off. Sixteen yards of line left attached to shot, which struck the ground 980 yards from the piece. The vibrations of the line split the end and side of the faking-box (A) into 4 or 5 pieces. The two faking-boxes above mentioned were rendered useless for further service in transporting lines.
	4	No remarks.
	5	Line (hemp No. 10) emptied into the two faking-boxes (A) mentioned in rounds 2 and 3. [These boxes will be referred to in following shots as "old faking-box A," &c. They were used (or at least one of them) until the 14th round to avoid breaking up new boxes.] Bevel on rear end of shot extended beyond face of piece.
	6	Line (No. 8) emptied into 2 old faking-boxes A, and part left in box B. Half of bevel at base of shot exposed beyond muzzle of piece.
	7	Line (No. 9) put in 2 old faking-boxes A for firing. Half of bevel on rear of shot exposed.
	8	Line in one old box A. Base of shot flush with muzzle of piece.
	9	Line (No. 10) in 2 old boxes A.
	10	Line (No. 8) in 2 old boxes A. One electric primer failed to explode.
	11	Line (No. 7) in 1 old box A. Could not tell whether the line was cut on the broken box or was broken by vibrations; 25 yards of line carried off by shot. Range, 704 yards; deviation, 5 yards to right.
	12	Line (No. 7) in 1 old box A.
	13	Line (No. 6) in 1 old box A. The gun was probably not pointed properly by the assistant. The line caught on the broken end of the box, which may have changed the direction of the shot somewhat, but not enough to account for the marked deviation of the shot. The box was on the right of the gun. From the insignificant difference between the deviation of the shot and the "drift," as measured from the 300-yard stake, the writer is inclined to the opinion that the gun was not properly pointed. The assistant did not recollect whether he verified the alignment of the gun or not.
	14	Line (No. 5) in 1 old box A. In the above cases the line was emptied from their own faking-boxes into those designated in this transcript of remarks. Wind at office at end of 14th round, 20.6 miles per hour.
21	15	Line put in tray before firing. The line (No. 9, linen) was fired from the coil as received from the manufacturer. The line run out in a fusiform helix, each coil putting one twist in the line. For this and the subsequent rounds the *Casella* air meter for determining the surface velocity of the wind was placed 50 yards in front of the gun instead of 200 yards in front, as before.
	16	Line emptied into tray. Nearly all of the line carried out.
	17	Line emptied into tray. Three tiers of fakes left in tray.
	18	Line emptied into tray. Line broke 18¾ yards on shot. Projectile rotated about shorter axis; shank slightly bent when shot struck the ground. Range, 920 yards.
	19	Line emptied into tray before firing.

1. *Synoptical transcript of notes from the firing record*—Continued.

GUN A.—CALIBER, 3 INCHES—Continued.

Date.	No. of round.	
1878. May 21	20	Line emptied into tray before firing. In faking, about a dozen coils had been placed in the bottom of the box before proceeding with the faking; when ready to fire, these loose coils were on top of course, and not being faked in small lengths, allowed excessive amplitude of vibration at the instant of discharge. The line broke short off, not even taking out all the coils. The fakes below were undisturbed. Range of shot, 930 yards, carrying 6¾ yards of line with it.
	21	Line put in tray before firing.
	22	Line put in tray before firing, in three lots. [Was faked in three boxes.]
	23	Line put in tray before firing.
	24	Line put in tray before firing.
		The above 24 shots were fired with "electric primers" for convenience.
22	25	Fired out to sea. Estimates of range made in this and three succeeding shots by 4 different persons, all accustomed to estimating distances on the water. The recorded range (300 yards) is below all estimated ranges given, so as to be sure to fall within the limits of truth. The writer places little faith in estimated distances, as they generally are very inaccurate, especially upon water.
	26	Fired out to sea. Line wet, rough, stiff, and covered with sand. It lay in loose coils on the beach where it had been hauled in "hand-over-hand" through the water and sand. Action of the line pretty good; a few snarls were seen, but they were very small. Range variously estimated from 275 to 300 yards by those present.
	27	Fired out to sea. Same line hauled in and placed on the sand in two loose coils. Line wet and sandy, kinked badly. Range variously estimated from 180 to 275 yards; recorded as between 180 and 200 yards.
	28	Fired out to sea. Line hauled in and placed in one coil on the beach. All kinks or snarls removed. Action of line very good, no snarls. Estimated range "about same as last shot," but recorded as 175 yards. Absorption of water by the line evidently tells more or less upon the range.
		"Service primers, long," used for the last four shots. The same line (Italian hemp No. 4½) and projectile were used in firing the four shots to sea. Heavier charges of powder would have been used, but none heavier happened to be at hand at the time. The object of the shot was more to witness the action of the line when wet and sandy than to obtain any definite range. Action of gun-carriage on sandy beach very good.

HOOK, N. J.

iber 2 inches.

iros., Boston, Mass.]

Date.	Number of rounds.	Material.	Number.	Length — Yards.	M
1878.					
Mar. 8		ian hemp....	3½	700	
16		ian hemp, No. old).	4½	700	
16		en, No. 1..... ian hemp....	7 3½	700	
16		en..........	4½	700	
16		o	5	700	
May 11		ian hemp, No. (old).	4½	700	
13		en, No. 1 (old)	7	600	
13		en, No. 2 (old)	7	600	
13		ian hemp....	4	700	
13		o	4½	700	
13		o	5	700	
13		o	6	600	
13		o	7	600	
13		en..........	3½	700	
20		ian hemp....	6	600	
20		o	4½	700	
20		en, W. P.....	4	700	
20		en..........	3½	700	
20		ian hemp....	5	700	
20		o	7	600	
22		ian hemp, W.	4	700	
22		o	4	700	
23		en, W. P.....	4	700	
23		en..........	4	700	
23		k linen......	4	700	

of the 200-yard stake.

ater-proof.

| 25 | Line emptied into tray before firing.

1. *Synoptical transcript of notes from the firing record*—Continued.

GUN B.—CALIBER, 2 INCHES.

Date.	No. of round.	
1878.		
March 8	1	For this and the four succeeding rounds the smooth-bore bronze gun B was mounted upon a block of wood weighing 48 pounds. Italian hemp line No. 3½ broke close to the shot. Projectile ranged over 700 yards, and was lost in a wooded tract of land.
16	2	Shot had no cap and was placed in the gun with its base toward the muzzle. One ½-inch wooden sabot used. A good line shot.
	3	No cap on shot; one sabot used; base of shot toward muzzle. About 100 yards of old linen line (diameter 0''.22) used, between the shot and hemp line No. 3½, to receive the first shock of the discharge. The large line broke—probably burned off inside the shot by the gas which entered the axial cavity.
	4	Lead projectile "upset" slightly by the shock of discharge. Only one rotation of shot about shorter axis could be detected. Flight of shot and action in the trajectory excellent. Bore of gun found to be "leaded," due to the upsetting of the shot and the consequent friction.
	5	Same projectile used. It had probably been bent slightly by striking the ground, and had to be filed a little in order to enter the bore.
May 11	6	Velocity of wind 18.18 miles per hour as indicated by a Robinson anemometer upon the ordnance office at Sandy Hook. This instrument was about 50 feet above the surface of the ground and 200 yards from the firing point.
13	7	Velocity of wind 15 miles per hour by office anemometer just before experiments began. Base of shot flush with the face of the muzzle when the gun was loaded. Wind variable.
	8	Base of shot flush with face of piece. Wind almost calm at instant of firing.
	9	Base of shot flush with face of piece. Wind increasing.
	10	Base of shot flush with face of piece.
	11	Base of shot flush with face of piece. Vibrations of line started the dovetailing in end of faking-box.
	12	Base of shot flush with face of piece.
	13	Base of shot flush with face of piece. Powder charge compressed in loading. Wind at office 12.4 to 13.9 miles to 20 miles per hour as taken within 10 minutes after round 13 was fired, from the anemmometer on the building. Wind very variable during the whole forenoon.
	14	Base of shot flush with face of piece. Projectile rotated about its shorter axis throughout the greater part of the trajectory. Vibrations of line No. 3½ started dovetailing of box D on side next to the gun.
20	15 16 17 18 19 20	Readings of Casella anemometer not taken at 200-yard stake—no time. Direction of wind variable within small azimuthal limits—general direction, "head wind." Velocity of wind at office (Robinson anemometer, elevation about 50 feet) varied from 18 miles to 24 miles per hour; wind came in gusts; weather damp, and showery part of the time. S. I. Kimball, general superintendent United States Life-Saving Service, and Capt. J. H. Merryman, United States Revenue Marine, inspector of that service, both present.
22	21	Fired directly against the wind and out to sea. Line either cut on button of box or broken; appeared to be cut; uncertain. Shot lost.
	22	Fired out to sea directly against wind. Range estimated by those present to be from 400 to 450 yards; true range unknown; lowest estimate inserted in table. Velocity at office 20 miles per hour.
23	23	Reading of anemometer uncertain; probably too great. Shot rotated several times. Line in tray.
	24	Line emptied into tray before firing. Shot rotated in horizontal plane.
	25	Line emptied into tray before firing.

ɒY HOOK, N. J.

aliber, 2.5 *inches.*

gton Bros., Boston.]

Material.	Number.	Le[n] Yards.
Old linen No. 2..	7	600
Same line and projectile used for twenty consecutive shots. Linen line No. 2, used in first series of experiments, was used in this series of experiments.	Same line used for twenty shots.	These shots made to compare merits of the powders used.
150 yards linen	7	150
Italian hemp...	3½	700
Linen..........	7	150
..do..........	3½	700
....do..........	3½	700
Italian hemp....	4½	700
....do..........	4½	700
....do..........	5	700

1. *Synoptical transcript of notes from the firing record.*

GUN C.—CALIBER, 2.5 INCHES.

Date.	No. of round.	
1878.		
May 6	1	Reading of anemometer uncertain, instrument not leveled. The gun was discharged by means of "service friction primers, short," from the 1st to the 6th round, both inclusive.
	2	Anemometer reading uncertain.
	3	Gun probably aimed to the right.
	4	No remarks.
	5	No remarks.
7	6	No remarks.
	7	"Service primer, long"; one failed to explode. These primers were used from the 7th to 20th round, both inclusive. Lanyard used in connection with these primers.
	8	A couple of fakes caught and knotted.
	9	Two small knots in line.
	10	One large knot; fakes got looped over each other and carried out a long knot. Velocity of wind 15 miles per hour, by instrument on top of office (about 50 feet above the ground), distant about 200 yards from firing point.
	11	No remarks.
	12	Vibrations of line split the end of the faking-box next to the gun.
	13	No remarks.
	14	No remarks.
	15	Velocity of wind 18.95 miles per hour, by instrument on office.
8	16	Wind very light.
	17	Wire pulled out of primer, and the gun "hung fire."
	18	Two knots in line, one small and one large; fakes caught each other.
	19	One large knot in line; fault of man who faked the line.
	20	Loosened end of faking-box. Line whipped out in knots, but all the knots came out while the line was in the air.
10	21	Line No. 3½ (Italian hemp) broke near the knot where it was tied to linen line No. 7. A piece of new linen line No. 7, 150 yards in length, was fastened to the shot to receive the first shock of the discharge, and the other end was made fast to Italian hemp line No. 3½. The small line broke, and the shot ranged 550 yards, carrying the 150 yards of heavy line with it. The shot fell 20 feet to the left of the plane of fire. A careful examination of hemp line No. 3½ disclosed the fact that it was quite brittle in fiber, harsh to the touch, and that it could be broken easily by using the hands alone. Dipping the line in water increased its tensile strength very much. The fibers of the Italian hemp appeared to be so brittle that the smallest lines made from it are almost worthless. Commenced using "electric primers" with this round.
	22	The same piece of linen line (150 yards of No. 7 line) used in above round was tied as before to a No. 3½ linen. Either one of the lines broke at the knot, or else the knot slipped and came untied. There was nothing in the appearance of the ends of the lines to indicate which had actually occurred. The shot with the large line attached ranged 541¾ yards, and fell 6 feet to the left of the plane of fire.
	23	Velocity of wind at office (elevated anemometer) 12.81 miles per hour. The shot carried out all the line (linen No. 3½), the end being found 30 yards from the faking-box There were seven kinks found in the line, two of which were pretty bad ones.
	24	Line (Italian hemp No. 4½) broke; cause, lateral vibrations and brittleness of fibers. Shot carried away 30½ yards of line. Range of projectile, 807 yards; deviation from plane of fire, 60 feet to the left.
	25	Velocity of wind at office 15.93 miles per hour.

1. *Synoptical transcript of notes from the firing record*—Continued.

GUN C.—CALIBER, 2.5 INCHES—Continued.

Date.	No. of round.	
1878.		
May 10	26	Started the dovetailing of faking-box C, near the top, on the side nearest to the gun. This box had one hasp broken in transportation. The brass hinge-pin had been riveted too tightly.
	27	No remarks.
11	28	Italian hemp line No. 7. The line broke squarely off, leaving 27 feet attached to the shot. The violence of the up-and-down vibrations of the line was sufficient to split the bottom of the faking-box. Range of shot, about 1,100 yards.
	29	Broke end of faking-box. Velocity of wind at office, from observations two minutes apart, was 34.6 miles and 36 miles per hour. Five minutes after shot was fired, surface velocity of wind was 25 feet and 31.66 feet per second.
	30 31 32 33	Wind gusty. Direction of wind ("side wind") caused the line to drift badly to one side of the plane of fire. A strong rear or side wind allows the projectile to move more or less sidewise, thus exposing more surface to the action of the air, and, consequently, increasing the resistance of the air and diminishing the range. With a strong head wind, the strain of the line upon the oblong projectile appears to keep the point up and to extend the range somewhat. During one hour the velocity of the wind was taken at equal intervals at the office (anemometer 50 feet above the ground) with the following serial results, viz: 11.54, 19.0, 17.47, 21.18, 26.86, 22.8, 22.0, 19.8, 11.92, 18.7, 24.3, 12.5, 24.6, 22.5, 30.5, 26.4, and 22.5 miles per hour. In round No. 33, Italian hemp line No. 4, "ordinary finish," drifted so far to the left that it fell into the salt water. The exact "drift" could not be measured, but was a little more than 75 yards. The line caught on an old jetty under the water; two men pulling on the wet line could not break it, though each of them took a couple of turns around his arm and placed the line over his shoulder in order to exert more fully his strength. The line was cut in order to recover it. The wet line was very difficult to fake, being stiff and rendered sticky by the loosened starch finish.
22	34	Line emptied from faking-box into tray before firing. Shot rotated three or four times.
	35	Line emptied into tray as before. Shot rotated about five or six times. Velocity of wind at office 21.9 miles per hour.
	36	Line emptied into tray as before. All of the line carried out except 4 tiers of fakes.
	37	Line emptied into tray as before. All of the line but about 50 yards carried out.
	38	Line emptied into tray as before. All of the line carried out. End of line 10 yards from tray. Line had too much paraffine on it; felt very greasy.
	39	Line emptied into tray as before. All of the line (No. 5) except 9 tiers carried out.
	40	Line emptied into tray as before. All but 7 tiers of the line carried out. Wind gusty during the above experiments for this day. Velocity of wind at office 17 miles per hour, immediately after fortieth round.
	41	Fired out to sea directly against the wind. No drift to the line. About 600 yards of line drawn out of box. Range unknown; lowest estimate given by those present was over 450 yards. Probably did not vary much from that distance. Action of projectile in the trajectory during its flight, excellent. Shot recovered by hauling in line. Recoil of gun and carriage, 15 feet.

1. *Synoptical transcript of notes from the firing record*—Continued.

GUN C.—CALIBER, 2.5 INCHES—Continued.

Date.	No. of round.	
1878. May 22	42	Fired to sea directly against the wind. The line was in loose coils on the sandy beach. The wet line was hauled in through the water and sand "hand-over-hand" and coiled without any care whatever, in order to ascertain what could be done in a similar case when the circumstances required great haste. This line, with the "water-proof finish," was stiff, but held less sand and was not nearly so sticky as that having the "ordinary finish." It was deposited in three coils near together, and was fired. The first coil, though somewhat kinky, ran out pretty well; part of second coil ran out, when the remainder was caught up by a vibrating loop, forming a bad tangle, through which the cord was drawn tightly until it broke or was cut by the other coils. This large mass of rope, over a foot in diameter, was carried out to sea over 80 yards before the line parted. The recoil of the gun-carriage was about the same as in the previous shot. The action of the gun-carriage upon the sand was unexceptionable; it slid to the rear easily without any tendency to turn over whatever.

CHAPTER III.

VELOCITY AND FORCE OF THE WIND.

In this chapter will be given tables containing the velocities of the wind from one-hundredth of one foot per second to one hundred and fifty feet per second, with their equivalents in miles per hour; also the pressure per square foot in pounds for the different velocities of the wind from one mile to one hundred miles per hour.

The velocities of the wind as recorded by the signal-service self-registering anemometer are given for the days upon which experiments were made at Sandy Hook, N. J.

The data for Sandy Hook, N. J., were kindly furnished by the Chief Signal-Officer of the Army and by Sergeant P. J. Huneke, United States Signal Service.

I.

Table of velocities of the wind

VELOCITY OF THE WIND.

Per second, feet.	Per hour, miles.	Per second, feet.	Per hour, miles.	Per second, feet.	Per hour, miles.	Per second, feet.	Per hour, miles.
.01	.007	1	.68	16	10.91	10	6.82
.02	.014	2	1.36	17	11.59	20	13.64
.03	.021	3	2.05	18	12.27	30	20.45
.04	.027	4	2.73	19	12.95	40	27.27
.05	.034	5	3.41	20	13.64	50	34.09
.10	.068	6	4.09	21	14.32	60	40.91
.20	.136	7	4.77	22	15.00	70	47.73
.3	.205	8	5.45	23	15.68	80	54.54
.4	.273	9	6.14	24	16.36	90	61.36
.5	.341	10	6.82	25	17.05	100	68.18
.6	.409	11	7.50	26	17.73	110	75.00
.7	.477	12	8.18	27	18.41	120	81.82
.8	.545	13	8.86	28	19.09	130	88.63
.9	.614	14	9.55	29	19.77	140	95.45
1.0	.681	15	10.23	30	20.45	150	102.27

II.

Velocity and force of the wind.

Velocity per hour.	Pressure per square foot.	Character of wind.	Velocity per hour.	Pressure per square foot.	Character of wind.
Miles.	*Pounds.*		*Miles.*	*Pounds.*	
1	0.005	Hardly perceptible.	17	1.422	
2	.020	Just perceptible.	18	1.594	
3	.044	Do.	19	1.776	
4	.079	Gently pleasant.	20	1.968	
5	.123		25	3.075	Very brisk.
6	.177	Pleasant.	30	4.429	
7	.241		35	6.027	High wind.
8	.315		40	7.873	
9	.399		45	9.963	Very high wind.
10	.492		50	12.300	A storm or tempest.
11	.595		60	17.715	A great storm or strong gale.
12	.708		70	24.500	Violent gale.
13	.831	Pleasant; brisk breeze.	80	31.490	Hurricane.
14	.964		90	40.500	
15	1.107		100	49.200	Most violent hurricane.
16	1.260				

III.

Statement showing the hourly velocity of the wind at Sandy Hook, New Jersey, on the dates and at the hours below given, compiled from the records on file in the office of the Chief Signal-Officer, U. S. A.

[Elevation of anemometer above ground, 40 feet 7 inches.]

Date.	8.30 a. m. to 9 a. m.	9 a. m. to 10 a. m.	10 a. m. to 11 a. m.	11 a. m. to 12 noon.	11.30 a. m. to 12 noon.	12 noon to 1 p. m.	1 p. m. to 2 p. m.	2 p. m. to 3 p. m.	3 p. m. to 4 p. m.	4 p. m. to 5 p. m.	5 p. m. to 6 p. m.	Total.
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*
May 7, 1878				15		17	15	13¼	16	19		95¼
May 8, 1878		4½	6									10½
May 10, 1878	7	15	15	15								52
May 11, 1878			27	11½		20½	17	28	29			133
May 13, 1878					8	16	14	14				52
May 14, 1878	2⅓	4	1⅓	1⅓		¼	11⅓	13	13	13	12	71

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER, U. S. A.,
Washington, D. C., May 28, 1878.

OFFICE OF OBSERVATION SIGNAL SERVICE U. S. A.,
Sandy Hook, N. J., May 23, 1878.

LIEUTENANT: I have the honor to submit the requested information in regard to the velocity of wind on stated dates and hours, as far as the records now at this station enable me to do so. I have written to the Chief Signal Office for the missing data [*i. e.*, for May 7 to May 14, 1878].

Elevation of anemometer above ground, 40′ 7″.

Date.	Time.	Hourly velocity.					Total number of miles.	Average hourly velocity.
		10 to 11.	11 to 12.	12 to 1.	1 to 2.	2 to 3.		
May 21	10.00 a. m. to 2.00 p. m.	12	10	13	12	....	47	11.75
May 22	10.00 a. m. to 3.00 p. m	23	19	22	20	15	99	19.80
May 23	10.00 a. m. to 12.00 m..	18	13	....	....	....	31	15.50

Very respectfully, your obedient servant,

P. J. HUNEKE,
Sergeant Signal Service United States Army.

D. A. LYLE,
Lieutenant of Ordnance,
Sandy Hook, N. J.

IV. REMARKS ON THE EFFECT OF A CURRENT UPON THE SHOT LINE.

After communication has been established between the shore and a stranded vessel by means of the shot-line, another troublesome factor often intrudes itself into the problem. By this is meant the effect upon the line of an inshore current running parallel to the coast and between the shore and vessel, commonly called by surfmen the "set."

There is little doubt that the influence of this current has been usually underrated in those attempts to haul off a whip-line or hawser which have failed. No definite calculations upon the effect of this current can be made at the present time from the lack of the necessary experimental data. This subject has already engaged the attention of the Chief of the Life-Saving Service, and steps have been taken for the purpose of eliciting information upon this important point.

PART IV.

HISTORICAL.

NOTE.

This part of the report is devoted to the history and use of the Manby apparatus, to some others of more recent date, and to the Boxer life-saving rockets.

The Manby apparatus is described in detail in books not generally accessible to those most interested in the results of Captain Manby's experiments.

The same may be said in regard to the Boxer life-saving rocket, which is now generally used in England, and is also used to some extent in this country.

The descriptions transcribed have been accredited to the sources from which they were taken, and have, by preference, been given in the phraseology of their authors.

These extracts exhibit the results of many valuable experiments. It is of the first importance that those charged with the use of such apparatus should be in possession of all the knowledge upon the subject that can be obtained.

The desire of the writer to place these instructive papers within the reach of the keepers of life-saving stations must be his apology for introducing them.

D. A. L.

CHAPTER I.

SECTION I. HISTORY OF MANBY'S LIFE-SAVING APPARATUS.

[Extract from Encyclopædia Britannica, eighth edition, Vol. XIII, pp. 440–445.]

It had occurred to Lieutenant Bell, in 1791, that a rope might be thrown from a ship which had struck, by means of a mortar carrying a heavy shot, and upon the principle of the gun-harpoon; and he showed the practicability of the suggestion by an actual experiment, in which a deep-sea line was carried to a distance of about 400 yards. (Trans. Soc. Arts, XXV, p. 136.) He recommended that every ship should be provided with a mortar capable of carrying such a shot, and observed that it might be placed on a coil of rope to be fired, instead of a carriage. The line was to be coiled on handspikes, which were to be drawn out before the mortar was fired.

In 1792 he received a premium of fifty guineas from the Society of Arts (Transactions, X, p. 204); and he obtained his promotion in the ordnance as an acknowledgment of his merits. The shot was to weigh about 60 pounds or more, and the mortar 5 or 6 cwt. The experiments of the French artillery at Lafere were subsequent to those of Mr. Bell, though they have sometimes been quoted as the first of the kind. * * *

The means to be employed by persons on shore, in cases of shipwreck, depend either on projecting a line over the ship or on the use of a life-

boat. Mr. Bell had cursorily observed that a line might be carried over a ship from the shore by means of his mortar; but for the actual execution of this proposal, in a variety of cases, we are indebted to the meritorious exertions of Capt. G. W. Manby, whose apparatus, according to the report of a committee of the House of Commons, dated in March, 1810, appears "to be admirably adapted to its purpose, and to have been attended with the fullest success in almost every instance." In consequence of this report, Captain Manby was thought worthy of a Parliamentary reward; and he afterwards published a description of his inventions, under the title of "An Essay on the Preservation of Shipwrecked Persons. 8vo. London, 1812." He had previously received a gold medal from the Society of Arts in 1808 (Transactions, XXVI, p. 209). His success makes it expedient to extract from his essay a detailed description of the apparatus, and it will be easy to make it somewhat more intelligible by a slight alteration of the order of arrangement:

The method of affixing a rope to a shot for the purpose of effecting communication, when projected from a piece of ordnance, over a stranded vessel, was at length succeeded in by introducing a jagged piece of iron, with an eye at the top, into a shell, and securing it by filling the hollow sphere with boiling lead; and in another way, by drilling a hole through a solid ball, and passing a piece of iron, with an eye to it, as before described, to the bottom, where it should be well secured by riveting.

To produce the means of connecting a rope to a shot, and prevent its being burnt, and rendering it "irresistible" to the powerful inflammation of gunpowder, was the labor of infinite time, and the number of experiments to accomplish it is beyond all possible conception. Chains in every variety of form and great strength breaking, proved that it required not only an elastic but a closer connected body. At length some stout platted hide (Fig. 5, Plate XLVII), woven extremely close to the eye of the shot, about 2 feet in length beyond the muzzle of the piece, and with a loop at the end to receive the rope, happily effected it.

This method is certainly desirable, as the rope may, immediately [as] it is required, be affixed to the loop, and applied in service. The form of the platted hide may likewise be woven by twisting it in the manner that the lashes of whips or ropes are spun. There is another method, by passing a rope through a case of leather, taking the greatest care that it is so well secured at the eye of the shot as to leave no room for the *slightest play*, as is represented by the annexed *barbed shot.** (Fig. 6, Plate XLVII.)

When the crews of the distressed vessel are incapable of availing themselves of the benefits arising from communication, they having previously lashed themselves in the rigging to prevent being swept away by the sea, which is repeatedly breaking over them, and when, from long fatigue and the severity of the storm (on which occasion it too frequently occurs), they totally lose the use of their limbs and are rendered incapable of assisting themselves in the slightest degree, the advantages of this shot are, that, on its being projected over the vessel and the people of the shore hauling it in, it firmly secures itself on some part of the wreck or rigging, by which a boat can be hauled to the relief of the distressed objects, and by the counterbarbs it is rendered impossible [that it should] give up its hold, or slip, while that part of the wreck remains to which it has secured itself.

Among the many that have been saved by this shot, the following are testimonials of a few of the cases:

"We, the crew of the brig Nancy, of Sunderland, do hereby certify that we were on board of the said vessel when she was stranded on the beach of Yarmouth, on Friday morning, the 15th of December, 1809, and compelled to secure ourselves in the rigging to prevent being swept away, the sea running so high on the vessel. And we do further declare and certify that Captain Manby, firing a rope with a hooked shot, securely holding on the wreck, enabled a boat to be hauled from the shore over the surf to our relief, otherwise we must inevitably have perished."

This certificate is attested by six signatures.

Facilitating communication is at all times of importance; but when the stranded vessel is in momentary danger of going to pieces, this point becomes a consideration of extreme urgency. I feel a persuasion that this particular service can only be carried into effect by a small and light piece of ordnance, the range of which is conse-

*The writer can find no record of the adoption by any government or society of Manby's barbed shot, or of any other anchor shot. Thus far the use of this class of projectiles seems to have been limited. Many practical difficulties in regard to their efficient use yet remain to be overcome.—D. A. L.

quently very inconsiderable, when compared with that of a large and heavier piece, as it is weight alone that conveys the rope. In order, therefore, to increase the powers of a shot projected from a small mortar, its natural form must be varied so as to give it additional "preponderance." The annexed shape, in the form of a pear (Fig. 3), has been used with the greatest success; for, by the increased weight, the shot's momentum and power over the line is in consequence considerably augmented in its range; and when made to fit the piece as close as possible, a great increase of velocity is likewise produced from that decrease of windage.

Fig. 3.

Portability in the construction of a piece of ordnance (as just described) is the very essence of this service; and communication with the stranded vessel or wreck may be effected with a cord, by which cord a rope can be conveyed, and by that rope a hawser or cable sent to the distressed vessel; for this purpose the annexed was constructed. (Fig. 7, Plate XLVII.)

A person completely equipped with every necessary apparatus to effect communication with a vessel driven on a lee shore, * * * the horseman, fully equipped, traveled a mile and a half, the howitzer was dismounted, and the line projected 153 yards, in six minutes.

The application of a small piece of ordnance likewise offers particular advantages, capable of being employed from a boat to go to the assistance of a vessel grounded on a bar when running for a harbor, the necessity of which repeatedly occurs, and was twice witnessed at Blakeney on the 10th of November, 1810, when boats endeavored to go to their relief, and were enabled to get out of the harbor on the ebb tide, within 20 yards of the vessel; but it was found impossible to approach them nearer. Had such boats been provided with a piece of this description, and the same firmly secured on a stout piece of plank, by the holes left at each corner of the iron bed, they might have projected a small rope, coiled in a crate or basket made to the form of the bow of the boat; and the persons in the boat so provided would not have remained the distressed spectators of the untimely end of their fellow-creatures without being able to afford them the smallest relief, although so little was then wanted for that desirable purpose.

Although advantages have been pointed out in the use of these small mortars, it is necessary to be kept in remembrance that they are produced for particular services, as the nature of the coast and circumstances attending the distressed vessel will direct what piece is best adapted to the undertaking.

To enable the mind to form a judgment of what can be effected by other pieces, the following are the minutes of experiments made with a 5½-inch brass mortar, stating the quantity of powder used and distance the ropes were projected against a strong wind, at the angle of 17° (elevation), weight of the mortar and bed about 300 pounds:

Ounces of powder.	Yards of 1½-inch rope.	Yards of deep-sea line.
4	134	148
6	159	182
8	184	215
10	207	249
12	235	290
14	250	310

With a short 8-inch mortar, the weight of which and bed was supposed to be about 700 pounds, the angles of elevation uncertain:

Ounces of powder.	Yards of deep-sea line.	Yards of 2-inch patent Sunderland rope, capable of hauling the largest boat from a beach.
32	439	....
32	479	....
32	....	336

Directions for using the apparatus.—When the rope (which should be pliant and well stretched) is brought on the beach or cliff opposite to the stranded vessel, the most even spot, and free from projecting stones, should be selected to lay it on, and great care be taken that no two parts of it whatever overlay or even touch each other, nor must it be laid in longer lengths than of two yards. But to project a small line or cord, it will be necessary, if it is required, to contract the faker to half a yard at most, to avoid the jerk received at the end of each right line. The best method, with such a escription of cord, is to lay it on the ground in the most short and irregular windings

to relieve it from this powerful impulse. To prove the effect of the impulse on a rope, if it is faked in lengths of 10 or 15 yards, it will break each time, as it then becomes a most powerful pendulum. These precautions are absolutely necessary to the success of the service.

The following has, after various trials, been found a certain method of laying the rope, and placing it into compartments. (*French Faking*, Fig. 1, Plate XLVIII.)

A particular attention to this mode will never fail with a good rope, when the impediments are removed that might otherwise obstruct its rapid flight. Its advantages are, that it will allow the eye rapidly (yet correctly, *just before firing*, which is absolutely necessary) to pass over the different compartments, and at once discover if any fake has been displaced by the storm, or by any other casualty or accident come in contact with another part, which would destroy its application by the rope breaking.

It may likewise be coiled in the manner used in the whale-fishery, *whale lair* (Fig. 2, Plate XLVIII); and in the method called *chain faking* (Fig. 3, Plate XLVIII). It is, however, necessary to add that great attention is required in laying it agreeably to the two latter methods, arising not only from the arm being liable to get under certain parts of the rope, and thereby displace it, but from the great anxiety of mind natural on these occasions, where the lives of fellow-creatures are literally dependent on the correctness with which the rope is laid. It is therefore extremely difficult, in a moment of agitation, to determine whether any overlay has taken place, an error that would infallibly destroy every endeavor, and occasion even the fate of those whose lives we might be exerting ourselves to preserve. Could persons in the performance of this service be always collected, the two latter methods would have a decided advantage over the first mode of faking, they being laid in a much less space of time. As all these methods of laying the rope occupy time to place it with the care necessary, and as it has repeatedly happened that vessels, very soon after grounding, have gone to pieces, and all hands perished, it was necessary to produce a method of arranging the rope so that it could be immediately projected as soon as it arrived at the spot; and none proved so effectual as when brought ready in a basket (Fig. 4, Plate XLVIII).

In this case, the rope should be most carefully laid in alternate tiers or fakes, no part of it overlaying, and it should be well secured down, that in traveling it be not displaced; but, above all, no mistake must happen in *placing the basket properly*. For example, that the end of the basket, from which the shot hangs in the above figure, should be previously marked, and must be placed toward the sea or wreck, that the rope be delivered freely, and without any chance of entanglement. It will be scarcely necessary to add, there will be several tiers of the rope when laid. The utmost care and attention are required in laying the rope in tiers with strict regularity, to prevent entanglement. The next is the application of the mortar. If the wind is sideways to the shore, it must be pointed sufficiently to windward to allow for the slack of the rope lighting on the object, as the rope will, of course, be considerably borne to leeward by the effects of a strong wind, and by its being laid at a low elevation insures the rope falling against the weathermost part of the rigging. While this service is performing, great care should be taken to keep the mortar dry; nor should it be loaded until everything is ready. When that is done, it should be primed; but as it would be impossible to do it with loose powder in a storm, a tube is constructed in the simplest manner of common writing paper (the outer edge being cemented with a little gum) in this form (Fig. 5, Plate XLVIII). It is filled with meal gunpowder, made into paste with spirit of wine; when in a state of drying, run a needle through the center, and take care the hole is left open, for, on the tube being inflamed, a stream of fire darts through the aperture with such force as to perforate the cartridge. The mortar should then instantly be fired; and in order to lessen a difficulty that has often occurred in performing this service, a pistol may be used, having a tin box over the lock, to exclude the effect of wind or rain on the priming; and the muzzle being cut [obliquely], dilates the inflammation, so as to require but little exactness in the direction of the aim.

We will suppose the communication to be secured, although it is scarcely necessary to offer any other assistance than that of a rope, as the inventive genius of a sailor will supply everything else; yet I could expect the people on shore to get a boat ready for meeting the vessel when driven on a beach. It is the promptest and most certain method of relief, as well as the most easy to be accomplished; for by hauling her off with the rope projected, the boat's head is kept to the waves, and not only insures safety by rising to the surge, but prevents her upsetting.

When the rope attached to the shot (not having barbs to it) is fired over the vessel and lodges, let it be secured by those on board, and made fast to some firm part of the rigging or wreck, that they may haul off a boat by it; but should there not be any boat, then haul on board by the projected rope a larger one, and a tailed block, through which a smaller rope is rove. Let the large rope be made fast at the masthead, between the cap and the top of one of the lower masts, and the tailed block a little distance below it; but, if the masts should have been cut or carried away, then it must be made fast to the loftiest remaining part of the wreck. When this is done, there will

be supplied from the shore a cot, hammock, netting, basket, hoop, or any of the numerous resources of seamen which will run on the larger rope and be worked by the people on shore. If a cot be used, the men may beso securely fastened to it as to preclude all possibility of falling out, and then be brought from the wreck, one by one, in perfect safety.

While communication is gaining, three stakes should be driven into the ground in a triangular position, so as to meet close at the heads to support each other. As soon as communication has been effected by the crew of the vessel and they have secured the line attached to the shot made fast to these stakes, the crew will haul on board by it a large rope and a tailed block, through which a smaller rope is to be rove, both ends of which (the smaller rope) are to be kept on shore. When they have secured these on board and the larger rope is rove through the rollers, let a gun-tackle purchase be lashed to it, then lash the purchase to the stakes. By the means of the purchase the larger rope may be kept at a fit degree of tension; for, if care be taken to slacken the purchase as the ship rolls out to sea, the danger of the rope being broken will be guarded against; and, on the other hand, if the purchase be gathered in as the ship rolls toward the shore, the slackness of the rope, which would prevent the cot traversing as it ought to do and plunge it in the water more than it otherwise would, will be avoided.

Supposing neither boat nor cot apparatus at hand, first cast off the shot from the projected rope, and with a close hitch let it be put over the head and shoulders of the person to be saved, bringing it close under each arm, drawing it tight, *observing particularly the knot is on the breastbone;* for, by having the knot in that position, on the people of the shore hauling the person from the wreck he will naturally be on his back, consequently the face will be uppermost to sieze every moment for respiration after each surf has passed over the body.

If circumstances compel recourse to this method, care must be taken to free the rope from any part of the wreck and to jump clear away; but should there be more than one on board, each man should make himself fast in the same way about foùr feet from the other and join hands, all attending to the same directions.

For giving relief to vessels stranded on a lee shore in a dark and tempestuous night.—It will be requisite, first, to devise the means of discovering precisely where the distressed vessel lies when the crew are not able to make their situation known by luminous signals; secondly, to produce a method of laying the mortar for the object with as much accuracy as in the light; thirdly, to render the flight of the rope perfectly distinguishable to those who project it and to the crew on board of the vessel, so that they cannot fail of seeing on what part of the rigging it lodges, and consequently have no difficulty in securing it.

To attain the first object, a hollow ball was made to the size of the piece, composed of layers of pasted cartridge-paper of the thickness of half an inch, having a lid on the top to contain a fuse (Fig. 6, Plate XLVIII), and it was then filled with about fifty luminous balls of star composition and a sufficient quantity of gunpowder to burst the ball and inflame the stars. The fuse fixed in the ball was graduated to set fire to the bursting powder at the height of 300 yards. Through the head of the fuse were drilled holes at equal [distances], to pass through them strands of quick-match, to prevent the possibility of any accident from the match falling out or from its not firing the fuse. On the stars being released, they continue their splendor while falling for near one minute, which allows ample time to discover the situation of the distressed vessel. During the period of the light a stand with two upright sticks (Fig. 7, Plate XLVIII), painted white, to render them more discernible in the dark, was ready at hand and pointed in a direct line to the vessel.

A shell affixed to the rope, having four holes in it to receive a like number of fuses (headed as before described), and filled with the fiercest and most glaring composition, which, when inflamed at the discharge of the piece, displayed so splendid an illumination of the rope that its flight could not be mistaken.

To get a boat from a beach over the surf.—The importance of going to the relief of ships in distress at a distance from the land, or for taking off pilots, was viewed as of the highest consequence by the elder brethren of the Trinity House, and offered to my particular attention by several distinguished characters. After numerous experiments to accomplish it in various ways, the mode following was most approved: About forty fathoms of 2¼-inch rope, made fast to two moving anchors, was laid out parallel with the shore, at a distance beyond the sweep of the surf; to the center of this rope was made fast a buoy, of sufficient power to suspend the great rope and prevent it from chafing on the sand, rock, or stones, as well as embedding, a circumstance that has rendered it impossible on a sandy or shingly coast to heave out an anchor with a rope to it from the shore. As this service should be performed in fair weather (to be prepared for the storm,) it may be regulated with the greatest exactness, and should take place at the top of high water, that the upper part of the buoy may be at the full stretch of its power, and only seen at that time. Should the shore be extremely flat, it will be desirable to place another set at a sufficient distance beyond the first to insure the operation of this method in any state of the tide.

The royal mortar, being brought to the spot, is to be pointed in the direction for the buoy, and should be laid at a very low elevation, but such as to insure the range; for the more it is depressed the less slack of rope there will be from the parabola formed in the shot's flight; the basket with the rope ready laid (having a barbed shot to it) is to be placed in the front of the mortar; on its being fixed, instantly haul the slack of the rope in, to prevent the effect produced on it by a strong tide; which being done, let the remainder be gently hauled in to insure the shot's grappling with the great rope; when that is caught and hooked, a power will be acquired fully adequate to the service.

As a cast-iron anchor appears particularly adapted to this method, and would be much cheaper than hammered, Fig. 8, Plate XLVIII, is a plan of one which the honorable the navy board approved, and allowed me to cast at their expense for the purpose of making the experiment.

When a vessel is in that extreme and perilous situation, driven under a rugged and inaccessible cliff, and in danger of going soon to pieces, the most prompt method I should suggest is by lowering to the crew a rope with stiff loops spliced into it (Fig. 9, Plate XLVIII), at the distance of a foot and a half from each loop, of sufficient size to contain the foot, by which they can ascend as a ladder.

This rope ladder is capable of being projected, and one of an inch and a half rope was thrown from a mortar 194 yards. It might also, from the simplicity of its structure, be extremely useful in escaping from a house on fire. By making one end fast to the leg of a bed or a table, the person would come down from the window in safety, and with much less difficulty and quicker than with the common rope ladder, which is heavier and more unwieldy. It has great advantages when employed in saving shipwrecked men in situations just described, when, from extreme cold and almost benumbed limbs, it would be impossible for them to climb up a rock or ascend it even by the aid of a common rope. The holds thus spliced in will support both hands and feet.

The report of the committee of the House of Commons contains also a paper of instructions for the managers of Captain Manby's apparatus on shore, which are somewhat more minute than the directions published in his essay. For example:

If the wind be sideways to the shore, the mortar must be pointed sufficiently to windward to allow for the slack of the rope lighting on the object, as the rope will of course be borne considerably to leeward by the effect of a strong wind.

The distance your judgment decides the vessel to be from the shore should regulate the charge of powder as stated in the scale, taking just a sufficient quantity to clear the object. An attention to this will be more certain of your effecting communication and guarding against the danger of the rope breaking or any other circumstance that might prevent the successful performance of the service. The elevation of 15° is to be preferred, particularly if the wind is sideways, pointing the mortar sufficiently to windward, as the rope would then fall against the weathermost part of the rigging of the stranded vessel.

When a vessel is driven on shore in the night, you will flash gunpowder as often as convenient on your way. This will animate the crew and denote to them you are coming to their assistance. On getting to the spot where you have reason to suspect the vessel lies, as you are not able to discover her from the extreme darkness, and if the people on board cannot [make known] their situation by luminous signals or noises (which they will be directed to make if possible), you will lay the mortar at a very high elevation and fire a light ball.

Just before you fire (the rope) it would be advisable to let off a blue light to put the crew on their guard, to look out, and be ready to secure the rope. The service can be performed with a carronade.

In Chapter IV we have a copy of directions to persons on board vessels stranded on a lee shore, proposed to be delivered to the masters at the custom-house. It is observed that even snapping a pistol, when the powder is wet, may sometimes afford a signal visible on shore from the sparks of the steel alone. The other parts of the directions will be supplied by those who understand the principles of the proposed mode of relief.

Rockets have of late years been much employed instead of the mortar in Manby's apparatus for throwing a line to a ship in distress. "Dennett's rocket apparatus" is supplied to many stations along the coast. The only advantage the rocket has over the mortar is its greater portability;

for, being much lighter, it can be used with greater facility among rocky cliffs, and in positions difficult of access. The disadvantages of rockets are, that they are somewhat uncertain, sometimes exploding as soon as ignited, to the danger of the by-standers; and they are also liable to deteriorate from the effects of damp or of age. Moreover, being expensive, they cannot be often employed in trials, so as to keep up the practice of the people employed in using them. The range of a shot from a 24-pound mortar, which is the ordinary size, is about the same as that of a 12-pound rocket, which is the largest in use. As the management of the mortar and rocket apparatus is much better understood by the officers and men of the coast-guard service than by ordinary boatmen and fishermen, it has been almost entirely left in their hands, and is provided by the board of customs.

Several inventions, or variations, in the Manby apparatus may be just glanced at. M. G. Delvigne uses a howitzer instead of a mortar, while a portion of the line to be carried is contained in the projectile. Mr. Greener has a method of discharging a rocket, with a line attached, from a light harpoon-gun. When discharged, the rocket ignites, and is said to prolong the range to a greater distance than if the gun or rocket were alone employed.

Captain Jerningham, R. N., has an anchor of a particular form, which he proposes to fire from a Manby mortar in sufficient numbers to afford the means of hauling a life-boat through the surf.

Mr. A. G. Carte employs a war-rocket instead of a Dennett rocket.

SECTION II.—MANBY'S SHOT.

[Extract from "Ammunition," by Captain Majendie, R. A., published in London in 1867.]

1. *History.*

The plan of saving lives in cases of shipwrecks by means of a line thrown so as to establish a communication between the ship and the shore seems to have been first proposed about the close of the last century, by Lieutenant Bell, Royal Artillery.[1] This officer proposed to project from a mortar a spherical shell filled with lead and having "a deep-sea line" attached. Some trials were made with the apparatus in 1791,[2] before a committee of the Society for the Encouragement of Arts, Manufactures, and Commerce, and the success of the experiment was so marked and unequivocal[3] that in the following year the society adjudged the inventor a reward of fifty guineas.[4]

Lieutenant Bell's claim to the priority of the invention was also recognized by a committee of artillery officers assembled at Woolwich in May, 1811, to report on "Captain Manby's invention for saving the lives of shipwrecked mariners," this committee reporting that they feel that—

They should not entirely discharge their duty were they to omit observing that the committee of the honorable House of Commons do not seem to have been informed of all the means proposed by the late Lieutenant Bell, of the Royal Artillery, for the

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[1] It appears from Kane's List that Lieutenant Bell was promoted from sergeant to a lieutenancy in the invalid battalion.—(Kane's List of the Royal Regiment of Artillery, p. 21.)

[2] August 29, 1791.—(Repertory of Arts for 1808, vol. xiii, p. 315.)

[3] The line was thrown to a distance of 400 yards.—(*Ibid.*, 315.)

[4] A full account of the experiments and drawings and a description of the apparatus are given under the head of "Account of a method of throwing a rope on shore by means of a shell from a mortar on board a vessel in distress." By Lieut. John Bell, Royal Artillery, in the Repertory of Arts, 1808.

attainment of the same laudable object; it being stated in that honorable committee's report that "Mr. Bell's invention is totally inapplicable in all cases of vessels being stranded," and that Captain Manby's invention is new.[5]

In justice, therefore, to the memory of Lieutenant Bell, and to his surviving family, and with respectful deference due to the judgment of the honorable committee, the concluding of the seven observations inserted in one of the papers of Lieutenant Bell's account to the Society for the Encouragement of Arts, Manufactures, and Commerce, is subjoined in his own words, as published in that society's Transactions, and in the Repertory of Arts for 1808, p. 318, by which observations it appears *that Lieutenant Bell then proposed what Captain Manby has since so ably and so successfully carried into effect.*[6]

The passage "in Lieutenant Bell's own words," referred to by the com mittee is as follows:

There is every reason to conclude that this contrivance would be very useful at all ports of difficult access both at home and abroad where ships are liable to strike ground before they enter the harbor, as Shields Bar, and other similar situations, when a line might be thrown over the ship, which might probably be the means of saving both lives and property; and, moreover, if a ship was driven ashore near such a place, the apparatus might easily be removed to afford assistance, and the whole performance is so exceedingly simple that any person seeing it done would not want any further instruction.[7]

It is thus placed beyond doubt that Lieutenant Bell's proposition was not limited to throwing a rope from a vessel to the shore, but included the reverse operation of throwing a rope from the shore to the assistance of a stranded vessel, and this by almost exactly the same means as were subsequently successfully applied by Capt. G. W. Manby, R. N.

But if the merit of having been the first to propose this plan cannot, in justice, be conceded to Captain Manby, it is at least indisputable that that officer was the first practically to apply it, and that by his exertions the details were matured and the idea successfully carried into effect;[8] for, in spite of the success which had attended Lieutenant Bell's experiments, his proposition does not appear ever to have received official recognition, or to have been practically entertained or adopted.[9]

Captain Manby worked out the subject with great care and ingenuity, and in 1811 his plan was experimented upon by the committee of artillery officers before alluded to.[10]

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[5]This allusion to the opinion of the "committee of the honorable House of Commons" has reference to a report made by a committee of that house in 1810, in which Lieutenant Bell's claim to any merit attaching to priority of invention is ignored, and his proposition spoken of in the words quoted in the text, viz. as "totally inapplicable in all cases of vessels being stranded," while Captain Manby's proposition is treated as original. The incorrectness of this opinion is sufficiently shown by the passage from the report above quoted and by Lieutenant Bell's own remarks, which I have given farther on.

[6]The Annual Register for the year 1811, p. 521.

[7]Repertory of Arts for 1808, vol. xiii, p. 318.

[8] "Lieutenant Bell then proposed what Captain Manby has since so ably and successfully carried into effect."—(Report of Artillery Committee, Annual Register for 1811, p. 521.) (See, also, extract from Ency. Brit., xiii, &c., on a preceding page, beginning as follows: "Mr. Bell has cursorily observed that a line," *et seq.*—D. A. L.)

[9]It is not impossible that this arose from the fact that the inventor died shortly afterwards, in 1798.—(See Kane's List of Officers of the Royal Regiment of Artillery, p. 21.)

[10]This committee was composed of the following field-officers of artillery: Lieutenant-General Lloyd, Major-General Ramsay, Colonel Borthwick, Lieutenant-Colonel Rion, Lieutenant-Colonel Spicer, Lieutenant-Colonel Colebrooke, Lieutenant-Colonel Beerer, Major Gold, Major Buckner. Their report bears date, Royal Arsenal, Woolwich, 22d May, 1811, and is entitled "Report from the committee of field-officers of artillery, containing an account of the experiments made at Woolwich on the 18th and 20th May last, on Captain Manby's invention for saving the lives of shipwrecked mariners." Printed by order of the House of Commons.—(Annual Register for 1811, pp. 518 to 521.)

The results of these experiments were in the highest degree successful, and the adoption of his propositions was recommended.[11]

This recommendation led to an address being moved in the House on the 14th June, 1811, to the Prince Regent, "praying that he would be graciously pleased to order that Captain Manby's invention should be stationed on different parts of the coast, &c., and assuring him that the House would make good the expense."[12]

The propositions which Captain Manby had submitted to the committee were eight in number, from which the following are selected as being the only ones having a direct bearing upon the history of the present service life-preserving apparatus. A small brass howitzer, 3-pounder bore, which, with its carriage, weighed 62 pounds, and was strapped on to the fore part of the saddle of a mounted man, 200 yards of log-line being coiled upon a deal frame and slung as a knapsack on the back of the horseman, the line being projected from the howitzer by means of a "*kind of pear shot*, 1½ *diameters in length*," and weighing 4 pounds 12 ounces 12 drachms. By means of this shot, and with a charge of 2½ ounces of powder, the howitzer threw the line 143 yards. "Next, a method of affording certain relief to vessels stranded in the darkest night, with an improved mode of rendering the life-rope more distinguishable." This arrangement consisted, firstly, in firing what Captain Manby called "light balls," viz, paper shells filled with "stars," from a mortar, to throw a light over the scene; and, secondly, in projecting from the 5½-*inch mortar*, charged with 8 ounces of powder, a deep-sea line attached *to a shell with four fuses in it*.[13]

He also suggested at this time connecting the rope to the shot by means of "*some stout strips of hide plaited extremely close at the eye*."[14]

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[11] The committee were of "opinion that they cannot too strongly recommend an invention, the partial application of which has been attended with such beneficial effects. * * * It is also the wish of the committee to render their full tribute of praise to Captain Manby for his ingenuity in so much improving and bringing into practical use this invention, to the perfecting of which he has so zealously and skillfully devoted himself."—(Annual Register for 1811, p. 520.)

[12] The address was moved by Mr. Wilberforce.—(Annual Register for 1811, p. 521.)

[13] Captain Manby's other propositions and experiments, briefly described, were as follows: An arrangement for firing, "by chemical agency, of two substances, which ignite from coming into contact with one another"; a plan for laying and firing from a boat "when the sea is continually breaking over it"; an arrangement by which the rope is coiled in a basket and then carried to the spot required; a rope-ladder "intended to be projected or conveyed to a crew wrecked under a cliff," consisting of a single rope with loops spliced to it at convenient distances for the support of the feet and hands when climbing; "the distance a deep-sea line can be projected from the shortest 8-inch mortar" (in the course of this experiment a deep-sea line, with 68-pounder shot attached, was projected 439 yards; charge, 2 pounds; elevation, 23°); the distance an 8-inch barbed shot, "with a patent Sunderland 2-inch rope attached," could be projected (the distance was 336 yards).

These propositions will be found *in extenso*, as I have already intimated, in the Annual Register for 1811, pp. 518 to 521. Much interesting information will also be found on the subject of Captain Manby's original propositions in the Encyclopædia Britannica, vol. xiii, pp. 441 to 444, where copious extracts are given from an essay published by Captain Manby himself in 1812, entitled "An Essay on the Preservation of Shipwrecked Persons."

[14] Captain Manby's own words respecting this part of the subject are as follows: "To connect the rope to the shot and prevent it from being burned by the powerful inflammation at the discharge of the mortar was most essentially necessary, and success resulted from almost innumerable experiments; chains in every variety of form and size broke, and proved that not only strength, flexibility, and elasticity, but a body at once continuous and entire, was required. At length some stout strips of hide, plaited extremely close at the eye, happily effected the object so indispensably wanted." (Observations, with Directions on the Method brought into use by G. W. Manby.) See also Encyclopædia Britannica, vol. xiii, pp. 441 to 444, where nearly the whole "observations" (extracted from Captain Manby's published essay) are given with illustrations.

It is, therefore, placed beyond doubt that Captain Manby's original propositions included, among other contrivances, 1st. A pear-shaped or oblong shot; 2d. A shell of 5½-inch caliber; 3d. A shell containing four fuses; 4th. A plaited hide thong for the purpose of connecting the line to the projectile.

The immediate connection of these details with the history and origin of the present service pattern, Manby's shot, will at once be perceived, the projectile now used being of an oblong form, 5½-inch caliber, containing four fuses, and having a plaited hide thong. There is no record of the exact form in which Captain Manby's original propositions were adopted, but it would seem, from the "Observations," &c., printed respecting his inventions, as if the majority of them were approved and introduced. It is certain, however, that many were allowed to lapse and become practically obsolete; and it appears that the two projectiles most used were a spherical 24-pounder shot, or shell filled with lead, having an eye-bolt riveted to it, furnished with a stout twisted hide thong, for the purpose of attaching the rope, and a grapnel or oblong shot, with a barbed iron staple, to which the rope was fastened, projecting from one end.

Some demand for this class of stores in 1857–'58 led to experiments being instituted by Colonel Boxer, Superintendent of the Royal Laboratories, the result of which was the introduction and issue, in 1859 or 1860,[15] of an improved and modified Manby's shot, and the pattern then introduced is, with the exception of some slight alterations which were subsequently (in 1863 [16]) made in the thong, the present service pattern.

Spherical Manby's shot are not, however, altogether obsolete, a pattern of a 6-pounder having been deposited in the model-room of the Royal Laboratory in 1862,[17] to govern the supply on special demand.

Without entering upon a detailed description of the different plans proposed, from time to time, for establishing communication between a stranded vessel and the shore, it will, perhaps, be well to mention that Manby's apparatus is not the only one which has been used for this purpose. The following passage from the Encyclopædia Britannica will sufficiently indicate the variety and scope of these inventions. * * * [Here follows an extract from the Encyclopædia Britannica, already quoted in these pages.—D. A. L.] * * * Kites have also been suggested as a simple means of carrying a line from[18] a wreck to the shore,[19] and are manufactured for this purpose by the "Shipwrecked Mariners' Society, London Bridge."

The board of trade employed to a great extent, until 1865, Dennett's rockets, in preference to Manby's shot; and there can be no question hat the ba'ance of advantages inclines strongly to the side of the rockets.[20]

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[15] I cannot discover the precise date when these shot were introduced, but it appears that the first issues of them were made in May, 1860, for the use of the coast guard at Lowestoft; and this marks their first *practical* introduction. The proportions of these shot, and of the different stores, fuses, lines, &c., which together constitute a complete "Manby's apparatus," were not officially determined or laid down until the 25th of August, 1862. (See War Office Circular 730, par. 633.)

[16] 12th October, 1863.

[17] 13th January, 1862.

[18] Evidently they are not generally available for carrying a line in the other direction, as the wind will almost invariably be blowing toward the shore.

[19] The Times, 10th of December, 1864, contains two letters on the subject.

[20] Rockets are more portable, as also is the apparatus from which they are fired; they carry their own illuminating agent, and are thus independent of fuses, do not require so long a line as a shot fired from a mortar, where the angle of elevation is greater; and, finally, are more accurate, owing principally to the fact that the deflection caused by the action of the wind upon the line is in a great measure corrected by the rocket having a tendency to fly up in the wind's eye.

In 1832 (3d December) the ordnance select committee experimented with some

In 1865 a rocket proposed by Colonel Boxer, R. A., was adopted by the board of trade to supersede Dennett's rocket, to which it is preferred, because, "1st. The range of Colonel Boxer's rocket is little, if at all, inferior, and in every other respect it is much superior; 2d. The combination of Mr. Dennett's two rockets is very objectionable, and from their velocity they frequently carry away the line, and sometimes both do not ignite. They are also double the expense."[21]

These rockets are fast superseding Manby's shot at all stations, and the latter may shortly be expected to become entirely obsolete.

There are two natures of Manby's shot in the service: the 24-pounder oblong (Pl. XXXVIII, Fig. 1), or "cylindrical," and the 6-pounder spherical shot. They are designated 24-pounder and 6-pounder, respectively, from their calibers, not from their weights.[22]

The 24-pounder oblong, or "cylindrical" Manby's shot, is a cast-iron cylindro-conoidal projectile,[23] with a slightly rounded base,[24] and about 1¼ calibers in length.[25]

The shot is drilled down its longer axis for the reception of a wrought-iron bolt, which passes completely through the projectile from end to end,[26] and projects about five inches beyond the base, terminating in an eye, to which is attached a plaited hide thong 2 feet in length. Four holes (Plate XXXVIII, Figs. 1, 2), for the reception of "fuses,"[27] are drilled into the shot at the base, equidistant from one another and from the center of the base, and slightly inclining inwards.[28] These holes are

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Manby's and Delvigne's shot against Dennett's 9-pounder rockets, and "the result was a general conviction on the mind of everybody present, and shared by Mr. Delvigne, of the great superiority of the rockets over either of the other plans."

The rockets were fired singly and in couples at an angle of from 30° to 35°.

"The single rockets carried a line 240 yards, the double rockets 370 yards, with great steadiness of flight, and with less length and weight of line in proportion carried out than the pieces fired at 45°.

"The range obtained with Manby's apparatus, charge 12 ounces, was 200 yards; and with the same mortar firing Mr. Delvigne's elongated shot was 185 yards. The same shot, however, fired from the rifled 5½-inch howitzer at 28°, with 10 ounces, attained a range of 298 yards, but the line broke three times."—(Extract from Reports and Proceedings of Ordnance Select Committee, vol. i, p. 199.)

On the subject of the employment of rockets for carrying a line, see a work published at St. Petersburg, entitled "Application des Fusées au jet des Amarres Sauvetage, par Général-Major Konstantinoff," which contains a good deal of information upon this subject, and explains the construction of a rocket proposed by the author for this purpose very similar to the Boxer life-saving rocket.

[21] Report of Captain Robertson to the board of trade. The construction of this rocket and of the apparatus which is issued with it will be described in the section on rockets in a succeeding volume of this work.

[22] For weights, see farther on.

[23] Perhaps more strictly an obtuse cylindro-ogival.

[24] It is difficult to say whether this end should properly be called the "base" or the "upper end." When the projectile is placed in the piece this end is toward the muzzle, and is, therefore, strictly speaking, the "upper end," but the shot changes its position on leaving the piece, and what was the front of the shot in the gun becomes the base or hinder part during its passage through the air. Therefore, and as the term is a more convenient one to use, I have designated this end the "base" of the projectile. I have also hesitated between the terms "slightly rounded" and "nearly flattened" in describing the form of the base, but have selected the former as conveying, perhaps, a rather more correct impression of the actual shape.

[25] For actual dimensions, see Plate XXXVIII.

[26] A reference to the drawing of the section (see Plate XXXVIII, Fig. 2) will show the manner in which the bolt is secured to the shot, viz, by means of a projecting head or shoulder on the bolt, which is pushed into the shot from the base up to this shoulder, so much of the bolt as projects at the top of the shot being hammered down to form the head, and thus securely riveting the bolt into position.

[27] More properly lights (*vide infra*).

[28] The inclination given is just sufficient to throw the flame of the burning "fuses" free of the hide thong.

conical in form, and are about the same diameter as the fuse-holes of the 13 and 10 inch mortar shells.[29] They are about 3½ inches in length, and are roughed in the interior to afford a better hold to the fuses.[30]

The hide thong, or "strop," which is fastened to the eye-bolt, is made of four strips of raw horse-hide,[31] doubled through the eye and tightly plaited, the plait being further secured by being stitched in several places with hide.[32]

The end of the thong is formed into a loop, which is tightly woolded with fine tarred spun-yarn.[33]

The shot and bolt are painted black before issue; the thong is unpainted. These projectiles weigh (with thong) about 30½ pounds.

The 6-pounder spherical Manby's shot is rarely demanded, and is scarcely to be considered as a service projectile. It consists of a diaphragm shell filled with lead,[34] and having an iron loop fixed into it, to which is attached a thong similar to that of the oblong projectile. This shot has no fuse-holes. It is painted black before issue, and weighs about 8 pounds.

2. *Action of the Manby oblong shot.*

The action of the oblong shot is as follows: The end of a line[35] is made fast to the loop-hole of the thong; the rest of the line being carefully coiled either in a basket or upon the ground or deck,[36] and a fuse (Plate XXXIX, Figs. 1, 6) is placed in each of the four holes made for the purpose.

The fuses being uncapped, the projectile is placed in the piece[37] with

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[29] For the actual dimensions, see Plate XXXVIII, Fig. 2.

[30] This roughing is not effected in the same way as in mortar shells, by means of a sort of thread, but is done by cutting a number of shallow grooves about 0.2 inch apart around the sides of the holes.

[31] The hide is prepared with lime, and is technically known as "horse-hide-raw-lime." The strips are cut with a tapering toward each end, so as to give the required taper to the thong when completed. In the history of this projectile it has been mentioned that Captain Manby tried several materials for the thong before he adopted hide, and it is deserving of notice that Captain Jerningham, R. N., who carried on a large number of experiments with the apparatus, preferred manila-rope thongs to hide. In a report upon the subject he says, "Strops of manila rope were found to be the most serviceable."—(Captain Jerningham's report, Her Majesty's ship Cambridge, Devonport, April 27, 1860.)

[32] In a 4-plait of double hide. The hide known technically as "white horse," or "whit leather," is used for this purpose; it is the same material as is used for whip-thongs. Until 1863 fine wire was used for this purpose; hide is preferred to wire because the latter had a tendency to cut the thong.

[33] It was not woolded until 1863; by woolding the end, any chance of the line being cut is diminished.

[34] Diaphragm shells are used because there are no other shells of this caliber; and it has not been thought necessary to manufacture a separate projectile when a diaphragm shell answers the purpose perfectly well.

[35] The line generally used is a "deep-sea line"; but there is issued with each apparatus 113 fathoms of 1¼-inch rope. (See War Office Circular 793, par. 633.)

[36] The coiling of the line so that it may run out free without check is a matter of considerable importance. There are several ways of coiling it; in a basket, or, if the beach be even and free from large stones, as follows: The length of the fakes not to exceed two yards (Fig. 1, Plate XLIX), as if they are longer the rope is more liable to be broken "by the proportionately increased vibration."—(Instructions for the use of Manby's apparatus.)

Another way, as used in the whale-fishery, is as follows: [Shown in Fig. 2, Plate XLIX.—D. A. L.]

A third method, called "chain-faking," is sometimes employed. [See Fig. 3, Plate XLIX.—D. A. L.]

A fourth method is shown in Plate XL, Figs. 1, 2.

[37] A 5½-inch (Coehorn), mortar specially prepared (with a crutch for firing quill-friction tubes), was used for projecting these shot (see W. O. C. 793, par. 598) until 1866, but by 21-2-66, 51-20-8742, it was intimated that metal friction-tubes might be used with them. On an emergency they could be fired from a 24-pounder gun or howitzer.

its base toward *the muzzle*, and upon the discharge of the piece carries out the line, one end of which being retained, a communication is thus established between the vessel and the shore. The use of the hide thong is to remove the line from the immediate flash of the discharge, and so prevent it from being burned.[38]

The fuses serve, by the bright light which they give forth, to indicate the path of the shot and guide the firing party in laying the piece. The strength and direction of the wind must be considered in determining the direction to be given, the trajectory being affected by them to a very great extent, owing to the influence which the wind has upon the line.

With deep-sea line, and with the ordinary charge of 12 ounces, the range varies from 400 yards downward, according to the strength and direction of wind.[39]

The 6-pounder is used in the same way, with the exception that, having no fuses, the operation of fixing and uncapping them is dispensed with.[40]

These projectiles are mainly used to establish a communication between the shore and a stranded vessel,[41] but the principle is applicable to a variety of other purposes, &c.

3. *Charges for Manby's shot.*

The maximum charge for the 24-pounder oblong Manby's shot is only 12 ounces, giving, with 45° of elevation, a range from 400 yards downward, according to the strength and direction of the wind.[1] If a higher charge is used, the line is generally broken.[2] There are no data on the subject of the charge for the 6-pounder spherical Manby's shot. ("Ammunition (English), 1867," by Captain Majendie, R. A.)

[38] To connect the rope to the shot, and prevent it from being burned by the "powerful inflammation at the discharge of the mortar."—(Observations, with directions, on the method brought into use by G. W. Manby.)

[39] In some experiments carried on in the Royal Laboratory, 1859, with a charge of 12 ounces, elevation 45°, the range varied from 260 to 400 yards.

"For the Manby 24-pounder cylindrical shot the charge is 12 ounces, giving a range of about 300 yards."—(Captain Frazer's Notes on Matériel, p. 6.)

In Captain Manby's *Observations, with Directions, &c.*, he gives the following charges and ranges for the spherical 24-pounder shot. (As this shot consisted of a shell of 5½-inches caliber filled with lead, it must have weighed considerably over 24 pounds, and probably was about the same weight as the present oblong 24-pounder.)

Charge.	With deep-sea line.	With 1½-inch rope.
8 ounces	220 yards	180 yards.
10 ounces	270 yards	220 yards.
12 ounces	320 yards	250 yards.

It also appears that in the determination of these ranges the most unfavorable conditions had been taken, for in another part of his Observations Captain Manby says, "An iron mortar * * * will project a 24-pounder shot, with an inch and a half rope attached to it, 250 yards, or a deep-sea line 320 yards, *against the utmost power of the wind.*"

[40] No charge is laid down for the 6-pounder, nor are there any data to enable me to assign even approximate charges and ranges to this projectile.

[41] With respect to this, the natural and simplest application of the projectile, the value of the invention will be more readily perceived if we bear in mind that "the most fatal cases of shipwreck and the most frequent are those which occur within the distance of from 300 to 60 yards off the land."—(*Observations, &c.*)

Captain Manby quotes several instances in which lives have been saved by his apparatus; and doubtless our naval annals and the records of the board of trade would afford many other instances of its successful application.

[1] *Vide supra*, foot-note 39.

[2] In some *experiments* which were carried on in the Royal Laboratory at Woolwich in 1859 with elongated 24-pounder Manby's shot and deep-sea line, the line broke with a 1-pound charge. With a stouter line than deep-sea line (1½-inch rope, for instance) a heavier charge might perhaps be used.

4. *Fuse for Manby's shot.*

a. Old pattern fuse.

The Manby fuse was adopted at the same time as the Manby shot, viz. about 1859 or 1860, but no *official* approval of the fuse is to be found until 1862. An alteration was effected in this fuse in 1864, when the present pattern with paper lining was introduced. (Ammunition, 1867 (English), p. 238.)

b. New pattern fuse.

The fuse for Manby's shot[1] (Plate XXXIX, Figs. 1 to 6) is a frustum of a large mortar-fuse cone, taken at its thickest part,[2] and rather over three inches in length. The composition bore is concentric with the longer axis of the fuse, and is considerably larger in diameter than that of the mortar fuse[3], in order to increase the quantity of burning composition and the illuminating power of the fuse. The composition bore is lined with a hollow cylinder of rolled paper,[4] to prevent the fuse exploding on the principle of a tube, in the event of the wood shrinking away from the composition.[5] The composition bore is pressed[6] or driven with 2.5 inches of solid fuse composition, matched (Plate XXXIX, Figs. 1–5), primed, bored into, and capped (Plate XXXIX, Fig. 6), like a large mortar fuse.

The Manby fuse contains no side holes or powder-channels, not being intended to be prepared for any particular time of burning. The position of the first and second inches are indicated by rings cut round the fuse.

The fuse is painted drab all over, except the cap, which is not painted; a black ring is painted round the junction of the cap and fuse.

They are marked with the numeral, number of thousand and month and year of issue, in the usual way.

These fuses are intended for use with Manby's 24-pounder[7] life-saving apparatus at night. They are placed in the holes prepared in the base of the shot, four fuses in each shot, and being uncapped become ignited by the flash of the discharge, and serve to distinguish the path of the shot through the air and indicate any error that there may be in "laying." Strictly speaking, therefore, they are rather lights than fuses.[8]

The Manby fuses are issued in zinc cylinders, 16 in each, with a paper containing the following printed directions for use:

Fix the fuses firmly in the shot with the mallet and setter. Remove the caps from the fuses by giving the tape a sharp pull, when the shot is ready for firing.

NOTE.—Care must be taken to protect the priming of the fuse from moisture.—(Ammunition (English), 1867, p. 270.)

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[1] Present pattern (with paper lining), adopted 14th February, 1864.—[War Office Circular No. 1 (new series), par. 875. Respecting adoption of original pattern, see *supra*.—D. A. L.]

[2] As nearly as possible, the largest diameter of the mortar fuse is 1.565 inches; that of the Manby fuse, 1.59 inches; the development of cone of the two fuses is the same.

[3] The bore of the mortar fuse is .37 inch in diameter, that of Manby's fuse .75 (measuring outside of paper lining), or .6 inch (measuring inside of paper lining).

[4] 100-pound paper.

[5] "I find, in consequence of the largeness of the bore for the composition of the Manby fuse, the wood is liable to shrink, and thus cause the fuse to explode instead of burning. To obviate this I propose to insert a paper lining similar to that used in my naval time-fuse."—(Letter from Colonel Boxer to Director of Ordnance, 21st January, 1864.) This alteration was adopted 14th February, 1864.—(War Office Circular No. 1 (new series), par. 875.)

[6] By hydraulic pressure.

[7] The 6-pounder Manby shot have no fuse-holes.

[8] These fuses burn 12½ seconds. Limits 12 to 13 seconds.—(Ammu., 1867, p. 286.)

[N. B.—Some unimportant foot-notes have been omitted in making this extract.—D. A. L.]

CHAPTER II.

FRENCH LIFE-SAVING GUNS AND PROJECTILES.

The French life-saving service is in the hands of the "Société Centrale de Sauvetage des Naufragés," and according to Capt. R. B. Forbes, of Milton Lower Mills, Mass., this society only dates back to 1865.

Twopieces of ordnance, "le perrier" and "l'espingole," have been used by the French society for projecting lines over shipwrecked vessels.

Below are given the principal weights of these guns, projectiles, and charges, together with the greatest ranges obtained by an experimental commission of French officers in 1866.

Le perrier.

	French.	English.
Weight of gun	83 kilos.	182.98 pounds.
Elevation	30 degrees.	30 degrees.
Weight of powder charge	140 grams.	4.93 ounces.
Weight of projectile (flèche)	5 kilos.	11.02 pounds.
Extreme range	325 meters.	355.43 yards.
Deviation	17 meters.	18.59 yards.
Diameter of shot-line	4.5 millimeters.	0.1773 inch.

L'espingole.

	French.	English.
Weight of gun	20 kilos.	44.09 pounds.
Elevation	25 degrees.	25 degrees.
Weight of powder charge	50 grams.	1.76 ounces.
Weight of projectile (flèche)	2 kilos.	4.4 pounds.
Extreme range	180 meters.	196.85 yards.
Deviation	36 meters.	39.37 yards.
Diameter of shot-line	4.5 millimeters.	0.1773 inch.

In their report of November 17, 1866, the French commission appointed to consider the subject of life-saving apparatus expressed the opinion that *le perrier* with a projectile weighing 5 kilograms (11.02 pounds) and 140 grams (4.93 ounces) of powder, for ranges of 300 meters (328.089 yards), and *l'espingole* with a projectile of 2 kilograms (4.4 pounds) and 50 grams (1.76 ounces) of powder, for ranges of 180 meters (196.853 yards) and below, would be sufficient for all their needs. The French recognized the fact that a line 4.5 millimeters (0.1773 inch) in diameter will require a larger line to be hauled out to the wreck before attaching the "whip" or hauling line.

Delvigne's gun.

More recently M. August Delvigne invented a gun for projecting line carrying arrows. The following description of this piece is taken from Capt. R. B. Forbes's work entitled "Life-boats, Projectiles, and other Means for saving Life," published in 1872:

The new piece of ordnance got up by Delvigne weighs only 20 kilos., is made of gun-metal, almost a straight cylinder, about 18 inches long, and has an iron tail-piece screwed into the breech and pointed, so that in firing it is simply thrust into the soil until the square breech brings up; the elevation is regulated by a quadrant and plummet put into the muzzle; the bore is about 1¼ inch, or half that of the perrier; the piece carries wooden arrows, fitted with an iron tail to reach the charge, and at the muzzle these are much larger than the tail-piece, so that the shock of the explosion operates on the square base of the arrow, which is protected by a ring of metal.

In loading this piece a vacant space is left as in the others (*le perrier* and *l'espingole*), and the cartridge is fired near its outer end; the piece being very short, this brings

the vent about in the center of the length. The iron arrows are about one-third longer than the gun, and about half the length of the arrow is in the gun when ready to fire. The advantages claimed by Delvigne in this little piece over the long *perrier* and *l'espingole* are its cheapness and portability, while with sufficient charge it gives an equal or better range; besides the wooden and iron arrows, he fires a wooden arrow out of the *perrier*, or almost any gun, which has cross-bars of round iron made malleable to resist the shock. These cross-pieces are fixed at right angles to the arrow, near the outer end, and are about as long as three diameters of the arrow. It is found that in firing this, the cross-pieces are bent to an angle of about forty-five degrees with the plane of the arrow, and thus form an anchor or grapnel, useful for many purposes. I saw one projected at Vincennes about two hundred yards from a four-pound rifle-gun, which held on to the soil sufficiently to have broken the line of about inch stuff.

Having briefly described the various arms in use in France for casting lines, it becomes necessary to go a little into detail as to the means of attaching the lines, which without due knowledge and practice of the system will be quite useless.

The wooden "flèches," or arrows, are made both round and eight-square; the former must be accurately turned and the latter planed true; therefore the latter are more simple and easy to make on board ship, or on shore.

The "coulant," or, literally, *slider*, consists of half a dozen turns of line put on something, as a whipping is put on a rope, only the ends overlaid by the rest must be left out, so that the turns can easily be pulled taut; much depends on this being done right; if the turns are too tight, the becket with its double bight and the line moves too slowly, and the "coulant" jams half way, causing the flèche to wabble and turn over; and if put on too loose, it runs down when the gun is fired, so fast as to break when it arrives at the projecting ferrule at the base. It is not too much to say that all depends on this being done right; the flèche should be slightly greased and the line either fired from a ball or from the ground, as in mortar exercise. Practice has made this so perfect that in France failures seldom occur from this cause.

Arrows of wood have the advantage of floating if they drop near the wreck, and of being readily recovered when they go beyond or fall short. The iron flèche is intended for long ranges or strong contrary winds. The distance depends so much on weather, on the amount of charge, elevation, and the line running clear, that I will only say it varies from 180 to 350 meters (196.85 yards to 382.77 yards).

In 1872 Delvigne's new gun, weighing 20 kilos. (44.09 pounds), gave a range of 300 meters (328.09 yards), with a wooden flèche weighing 8 kilos. (17.63 pounds), and a shot-line 8 millimeters (0.315 inch) in diameter.

CHAPTER III.

SECTION I. 3-INCH PARROTT MORTAR—SMOOTH BORE.

1. DESCRIPTION.

This mortar is the invention of Mr. R. P. Parrott, of the West Point Foundry, Cold Spring, N. Y. It is made of cast iron and lined with a steel tube. The piece is cylindrical about the seat of the charge, gradually tapering to the face of the muzzle. The breech is hemispherical. The trunnions are placed near the breech; their projection upon a plane through the vent and axis of the bore, being in front of and tangent to a plane perpendicular to that axis and containing the front end of chamber. The chamber has the form of the frustum of a cone.

2. SHOT.

The projectile is of cast iron, cylindrical, with the ends rounded. An eyebolt is screwed into the base for the attachment of the line. The eye of this bolt is close to the base of the shot. The cylindrical portion is turned in a lathe so as to be almost a perfect fit for the bore.

3. Safety attachment.*

This contrivance consists of a piece of rubber, rectangular in cross-section, about 1′ long, 0″.75 wide, and 0″.5 thick, and of three or four galvanized-iron wires about 6′ long, laid parallel to each other, loosely twisted and coiled into a helix of from 18 to 19 turns. The rubber strap is sometimes placed inside the coil, and at others outside of it.

This combined strap and spring is interposed between the shot and line in firing. The object of the combination is to absorb the shock of the discharge, and thus prevent the breakage of the line, by letting the first jerk come upon the rubber, which will generally break, and then upon the coiled wire spring. The wires will be straightened out before the full strain falls upon the line.

4. Dimensions, weights, &c.

3-inch R. P. Parrott mortar.†

Exterior diameter at breech	8.2	inches.
Exterior diameter at muzzle	5.8	inches.
Steel tube: Thickness of walls	0.6	inch.
Thickness at bottom of chamber	1.4	inches.
Thickness of cast iron at breech	3	inches.
Total thickness of metal at breech, iron and steel	4.4	inches.
Diameter of bore	3	inches.
Chamber, frustum of cone: Length	0.9	inch.
Greatest diameter	3	inches.
Least diameter	1.4	inches.
Weight of mortar	201.5	pounds.
Weight of carriage, or bed, wood, about	65.5	pounds.
Total weight, mortar and bed	267	pounds.

Projectile.

Length	14.95	inches.
Diameter, scant	3	inches.
Weight, with safety attachment	24	pounds.

The writer is indebted to Mr. Kemble, of the firm of Paulding, Kemble & Co., for the above information in regard to the Parrott mortar.

5. Experiments with 3″ Parrott mortar, made at the West Point Foundery, Cold Spring, N. Y., June 20, 1877.

This trial took place under the immediate supervision of Capt. J. H. Merryman, United States Revenue Marine, inspector of the life-saving service, and in the presence of Mr. S. I. Kimball, of the Treasury Department, general superintendent of the United States Life-Saving Service. The writer also was present.

a. Firing-ground.

The firing was done over a marshy piece of ground; the mortar being placed upon a raised platform near the edge of the marsh. A flag was

*This device was invented by Capt. Douglas Ottinger, of the Revenue Marine, in the course of his experiments at the West Point Foundery. It is referred to by Mr. S. I. Kimball, in his "Annual Report of the Operations of the United States Life-Saving Service, 1876," p. 24.

†Mr. Parrott constructed two mortars of larger caliber, one for the station at Peaked Hill Bar and the other for a station adjacent to it, upon Cape Cod, Mass.

The following data are available in regard to these two mortars, viz:

Caliber, 3.5 inches; weight of mortar, 300 pounds; weight of bed, 222 pounds; total weight of mortar and bed, 522 pounds; weight of projectile, 33 pounds; charge of powder, 8 ounces; range, 496 yards.

posted 400 yards distant, to indicate the direction to be observed in pointing. After each shot a man was sent out to measure the deviation from the line of fire and to ascertain the range of the shot. The platform for the mortar was made of loose earth overlaid with 2-inch plank placed parallel to the plane of fire. Its arrangement and lack of solidity was such as to make the recoil of the piece appear more severe than it would have been under more favorable circumstances. The mortar platform was over 10 feet above the level of marsh.

b. Pointing.

The direction was given by the eye of the gunner, the elevation was obtained by means of a wooden quadrant and plummet. No great accuracy was observed in taking the elevations.

c. Shot-lines.

Three different kinds of lines were used upon this occasion.

1st. This was the smallest line—Diameter, 0″.22 (estimated). It was braided like sash-cord. It was manufactured by the Silver Lake Company of Newtonville, Mass. The material is linen thread. Its exterior finish was very smooth and hard. The length was 600 yards, and weight about 35 pounds.

2d. The diameter of this line was a little greater than that of the above. The material, Italian hemp; the length, 600 yards; weight, about 50 pounds. It was twisted in the usual manner. It is the kind heretofore employed in the service. It was manufactured by Cummings, of Philadelphia.

3d. An English rocket-line of Italian hemp, strands very loosely laid up; line very flexible. Diameter greater than that of either of the other lines. Length, 560 yards; weight, about 42 pounds.

d. Charges of powder.

These were measured, not weighed. Hazard's Standard "musket powder" was stated to have been used.

e. Record of firings with 3″ Parrott mortar, at Cold Spring, N. Y., June 20, 1877.

[Projectile, weight: 24 pounds. Elevation: 25° in every case. Kind of powder: Hazard musket.]

Number of round.	Powder charge.		Range.		Deviation of shot.		Kind of line.	Direction of wind with reference to line of fire.*	Remarks.
	Ounces.	Grams.	Yards.	Meters.	Right or left, yards.	Right or left, meters.			
1	4	113.40	370	338.33	17 L.	15.50 L.	Linen, Silver Lake (new).	W.	Light breeze.
2	6	170.10	350	320.04	10 R.	9.14 R.	Italian hemp (new)	W.	Light wind.
3	6	170.10	(Wire	broke.)	......	....	English rocket line	W.	Very light wind.
4	6	170.10	(Wire	broke.)	......	....	......do	W.	Barely perceptible.
5	6	170.10	281	256.95	6 R.	5.49 R.	......do	W.	Do.
6	6	170.10	434	396.85	6 R.	5.49 R.	Linen, Silver Lake	W.	Almost calm.
7	8	226.80	473	432.51	11 R.	10.06 R.	......do	W.	Light wind.

* The force and directions of the wind are approximations only, being estimated.

f. Action.

First shot.—Silver Lake linen line ran out beautifully, without kink or knot. Shot kept point first in latter part of trajectory. Recoil of mortar and bed about 6 feet.

Second shot.—Recoil, 7 feet; tore up platform and slid up bank in rear.

Third shot.—Wire broke near the projectile. Recoil of piece, 6 feet. Projectile rotated about its shorter axis.

Fourth shot.—Recoil of mortar severe, upset carriage and broke it slightly. Part of line carried out, wire broke again; shot rotated about shorter axis.

Fifth shot.—Same line tied directly to the shot without the interposition of the rubber and spiral spring. Line carried out all right. Recoil severe, mortar and bed turning upside down.

Sixth shot.—Line tied to shot. Violent recoil, mortar and carriage turning upside down upon the platform.

Seventh shot.—Same line used (Silver Lake), and tied directly to the shot. Line kinked, a large knot being found about 100 yards from the point of firing. Probably due to bad faking. Recoil very violent, mortar jumping from platform and turning upside down.

NOTE.—In his later projectiles Mr. Parrott has changed the form of the base, making it more pointed, and drilling a hole through it for the attachment of the line.

g. Result.

In regard to the above record of firings with the Parrott mortar, Mr. Kimball, the general superintendent of the United States Life-Saving Service, says: "At the trial a range of 473 yards was obtained. In view of this gratifying result, twenty-five of these guns were ordered and have been properly distributed."*

[Copy from printed record.]

SECTION II.—IMPROVEMENT IN PROJECTILES.

Specification forming part of letters patent No. 175742, dated April 4th, 1876; application filed March 6th, 1876.

To all whom it may concern:

Be it known that I, Robert P. Parrott, of Cold Spring, in the county of Putnam and State of New York, have invented a new and useful Improvement in Combined Projectiles and Life-Lines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms part of this specification.

This invention relates to those means for saving life by establishing communication from the shore or elsewhere with a vessel which has been wrecked, in which a shot or projectile having a line attached to it is thrown from a mortar. Ordinarily a round shot, having the line attached to it by a coiled wire, has been used for said purpose, but there has always been a difficulty in reaching a distant vessel, as the charge of powder, if increased, is apt to break the line at its attachment to the shot. In order to get greater range without thus exposing the line to breakage or disconnection, numerous attempts to attain the desired end

* See "Annual Report of the Operations of the United States Life-Saving Service for the fiscal year ending June 30, 1877," p. 40.

have been made with an elongated shot, which, owing to the reduced resistance it presents to the air over or as compared with the round shot, has a greater range for a given charge of powder. But in the previous use of elongated shots for the purpose practical difficulties have arisen, either as regards the disposition or connection of the line and in other respects, which have involved so much complication or otherwise been so defective, that objections have been raised to the use of them.

My invention not only obviates these defects, but combines, in the use of an elongated projectile for the purpose named, cheapness, facility, and efficiency. Thus I use a simple or plain elongated projectile, having no groove cut lengthwise in it for reception of the line as in a certain other method, but I attach the line by its coiled wire to the point or front end of the elongated projectile as inserted in the mortar, so that, when firing, the check which is produced as the shot feels the draw of the line causes the shot to be turned over end for end. This, by reason of the elongated form of the shot, materially eases the strain or reduces the first shock upon the line's attachment to the shot, and the shot, which draws the line after it, goes perfectly true to its destination. In this way, or by these means, I get a long range, and avoid breakage of the line's attachment to the shot, also secure a true travel for the latter.

In the accompanying drawing (Plate L), Fig. 1 represents a longitudinal section of a mortar with an elongated projectile having a life-line attached and as about to be thrown, the whole being constructed in accordance with my invention. Fig. 2 is a view on a reduced scale, showing the projectile after it has been turned end for end as it first feels the draw of the line upon it, and showing said shot with its attached line in the course of its flight. In Fig. 1, A is the mortar; B the elongated projectile, having the line C connected through the interposition of a spring or coiled wire D with the forward end of the shot as the latter is inserted in the mortar; and E is the charge of powder by which the projectile, with its attached line, is thrown from the mortar, said line being laid in a loose coil outside of the mortar. In Fig. 2 the same letters apply to like parts, but the shot has been turned end for end as it first feels the draw upon the line.

It is not necessary that the coiled wire D should of itself be the spring or only spring interposed between the end of the projectile and the line, inasmuch as a rubber strip or spring, F, may be independently applied to connect the line with the projectile and such elastic strip or spring be passed through the coiled-wire connection D.

I claim—

The combination with the elongated projectile B, of the line C, and interposed spring or coiled wire D, applied to connect the line with that end of the elongated projectile which is forward or outermost when the projectile is inserted in the mortar, substantially as and for the purposes herein set forth.

ROBERT P. PARROTT.

Witnessse:

HENRY JAYCOX.

ALEXANDER SKENE.

CHAPTER IV.

HUNT'S LIFE-SAVING APPARATUS.

SECTION I.

Mr. Edmund S. Hunt, of Weymouth, Mass., has invented a line-throwing apparatus, intended for life-saving purposes. A full description of this invention is given below in the specification forming part of the letters patent, and in the letter from Mr. Hunt to the Secretary of the Treasury, dated February 7, 1878.

The writer was present at several trials of this projectile. The results of his observations will be found upon subsequent pages.

IMPROVEMENT IN LINE-THROWING APPARATUS.

Specification forming part of letters patent No. 203274, dated May 7, 1878; application filed January 25, 1878. (See Plate LI.)

To all whom it may concern:

Be it known that I, Edmund S. Hunt, of Weymouth, in the county of Norfolk and State of Massachusetts, have invented certain improvements in line-throwing apparatus, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, making a part hereof.

My invention is more especially designed for throwing a line from the shore to a wreck or from a wreck to the shore, but is, of course, adapted to other uses.

The drawings illustrate a shot having my coil-case applied to it, also one of my hand coil-cases, and also a line-support attached to the gun.

The distinguishing characteristic of my invention consists in the projectile made up of a short heavy shot and a long light case containing the line, the case being open at the mouth, and the projectile adapted to be fired with the shot next to the powder and the coil-case at the mouth of the cannon, and to reverse itself soon after it leaves the gun.

The minor features of my invention relate to the mode of coiling the line and the mode of holding it and of preventing injury to it from the gases which escape from the mouth of the gun.

In that form of projectile shown in the drawings, A is the powder, B the shot, C the coil-case, and D the coil. E is a wooden mouth-piece attached to the case C, in order to make it sure that the sharp edge of C shall not injure the line.

The end *d* of the line is, where a light line is used, attached to a short piece of stouter line d^2, the line d^2 being less likely to be injured by the escaping gases, &c., near the mouth of the gun when fired. For a like reason the line d^2 is supported, as shown, by the supporter G, which prevents it from lying directly across the mouth of the gun, that being the most unfavorable position for it.

The coil is formed by winding the line upon a mandrel, the line passing through a vessel containing melted paraffine or other like substance, and also passing through a proper tension mechanism, to make the coil compact. A single coil is first wound of the desired length; next a

second coil over but the reverse of the first; then a third like the first but over the second; then a fourth like the second but over the third, and so on, forming a compact cylindrical coil, containing the desired length of line, the size of coil varying, of course, with the length and size of the line. The hand-coil is made in the same way. After the coil is put in the case a small amount of melted paraffine is appplied between it and the case, and it is thus held securely in the case.

I propose in practice to make the hand-coil of considerably heavier line than the shot-coil, using for the hand-coil the line d^2.

I prepare my improved apparatus by putting the hand-coil and shot-coil mouth to mouth and covering the joint with a short metal cylinder, and make the whole water-tight by a proper casing.

To use the apparatus, separate the hand-coil from the projectile, load the projectile mouth outward, place the line d^2 over the supporter G, as shown, and hold the hand-coil in the hand, its mouth in the same direction as the mouth of the gun. When the gun is fired, only a small portion of the line from the hand-coil will be drawn out. The length of coil in the shot should be considerably in excess of the travel of the shot, which will, of course, depend upon well-known principles.

I am aware of patent No. 23726, of 1859, to Trowbridge, which describes a sounding apparatus on a principle closely analogous to the principle of my new projectile; and I disclaim all that is described and shown in that patent.

I am also aware of the French patent to Delvigne, A. D. 1847, vol. 10, plate xlii, which shows a shell or hollow shot with a coil of line and a hole at the base of the shell through which the line extends. This I disclaim, as my projectile has the coil-case at that end of the shot farthest from the powder, and the mouth of the coil-case is at its front end when the shot is in the cannon, the shot proper being so much heavier than the coil-case and coil that when fired the projectile will reverse itself as soon as it leaves the gun, that is, when loaded the shot is behind the coil-case and the mouth of the case is forward, but during nearly the whole of its flight the shot is in front and the coil-case behind it, the mouth of the case being then at the rear of the projectile. In this way the coil-case can be made of sheet-metal, which is altogether too weak to resist the shock of the explosion, and the center of gravity of the projectile be brought very near the powder, thus protecting the coil and coil-case from the shock and from the gases without the use of a sabot or any other contrivance, besides greatly reducing the cost of the projectile.

What I claim as my invention is—

1. The projectile above described, composed of the shot B and coil-case C and coil D, the coil-case being open in front, and the shot B being much heavier than the coil-case and coil, the whole constructed and arranged substantially as shown, and adapted to be fired with the mouth of the coil-case outward, and to reverse itself as soon as it leaves the gun.

2. The coil composed of a series of coils, packed with paraffine or its equivalent, substantially as described.

3. The supporter G, in combination with the gun H, substantially as and for the purpose specified.

4. The improved mode of throwing a line above described, consisting in using a hand-coil in connection with a shot-coil, the latter coil being in a case or holder forming a part of and traveling with the shot and the former coil being held stationary, the lines composing the two coils being joined together at their contiguous ends, all as above described.

SECTION II.

[Mr. Hunt's letter to the honorable Secretary of the Treasury.]

WEYMOUTH, MASS., *February* 7, 1878.

SIR: Inclosed is a copy of my shell (3-inch) for carrying a line for life-saving purposes, a description of which I will now give.

The case of the shell is made of tin, with wings of the same. In the end is cast a leaden shot, made so as to fit the gun accurately without windage. The tin shell contains the line, wound, as the model shows, in the closest possible space. The line being prepared in paraffine and drawn from the center, comes out without fouling and without any drag on the shot, it traveling about as far with the line as without it. The wings are to keep the shell in line, and in so doing goes a much greater distance than if turning in the air. The coil, No. 2, I hold in my hand when the gun is fired, between which and the shell is a stout cord connecting the two small lines. On my gun is a rod, carried out from the gun in a line with the bore, with a fork or crotch in the end, that this connecting line is carried over, saving the line from breaking at the moment of discharge. The coil in the shell is the same as the 2-inch, only there is much more line in the shell.

In using, I place the powder in the gun and put in the shell shot end down; then carry the heavy line over the rod and hold the coil No. 2 in my hand, and apply the match. The result is this: the shell leaves the gun and immediately turns over and takes its course, the line paying out from it until it strikes the object intended. The explosion of the powder seems to throw the heavy cord that connects the two lines some two or three hundred feet from the gun, and then you find the end of line in the shell, so that a small part of the line is taken from the hand; and that is taken out by the fire explosion, and after the shell has reached the ground and the line being in the air, in falling draws from the coil. A shell size of the model will carry a line size of one now in it 1,000 feet with ¾ ounce powder at a very low elevation; with a shell of 2-inch diameter and a charge of 2½ ounces powder a range of one-half mile, carrying the same line, which, though being smaller, is very strong, being the same used by me for drawing a rope of sufficient size to tow a hawser in an exhibition before the Humane Society at Hull last week.

In this method of throwing line, a sufficient amount of line to reach the object must be always coiled in the shell, as, if the wind is directly ahead, but little, if any, line will be taken from the hand, and the slack of the line will fall behind you. For this reason it is always better to have ready more line in the shell than what is wanted for the distance the shell goes, a side wind taking up more line than a head wind or one with you.

The advantages I claim over the old methods are these:

1st. The line has no effect on the direction of the shell, it simply paying the line out, the shell going as directed with a side wind as with one with it.

2d. The shell goes seemingly as well with the line as without, so that distance is overcome very easily.

3d. The gun is a very small affair, my largest 3-inch gun for experiments weighing but 30 pounds. One that has thrown a shell and line ½ mile weighs 10 pounds without the carriage.

4th. The lines are all put up in paraffine, so that the weather cannot injure them from wet, cold, or heat.

5th. The whole affair, gun, shell, and line, can be carried by one man, requiring neither horse nor carriage.

Very respectfully, your obedient servant,

EDMUND S. HUNT.

Hon. JOHN SHERMAN,
Secretary of the Treasury, Washington, D. C.

N. B.—The above is a transcript of an official copy of Mr. Hunt's letter.—D. A. L.

SECTION III.—TRIALS OF HUNT'S APPARATUS.

I. FIRST TRIAL.

The first trial of this apparatus in the presence of the writer occurred at Weymouth, Mass., during the latter part of February, 1878.

The following is an abstract of a report of that trial made to the General Superintendent of the Life-Saving Service:

1. *Firing-ground.*

The firing-ground was very uneven, was covered by a growth of bushes and trees, and was intersected by a strip of swampy ground. At the point where the shot usually fell the ground was considerably higher than it was at the firing-point. A flag was placed at (an estimated) 400 yards distance from the guns. This flag was on or near the crest of the hill. No range had been *measured.*

2. *Guns.*

There were two of these:

1st. A 2-inch caliber, weight about 10 pounds; length of bore about 12 inches. This piece was made of a short length of "drawn" brass tubing, and had a reinforce of steel or wrought iron around the breech. The breech-plug was a piece of cast iron fastened to the cylindrical portion of the gun by two wrought-iron pins.

2d. This gun had a caliber of 3 inches; its length was a little greater than the 2-inch gun, and its weight was about 40 or 45 pounds.* It also was made of brass tubing. It had two reinforcing bands, the inner of steel or wrought iron, the outer one of brass. The cast-iron breech-plug was held in position by pins. It was stated by the inventor that these guns were only temporary contrivances to show the principle of his invention.

Though the whole gist of his invention is contained in his projectile, it has been deemed necessary to a definite understanding of the subject to give some of the more prominent correlative details.

3. *Projectiles.*

These were tin cylinders with leaden heads cast upon them. The coils of line were stored inside the shells. The total length is between 16 and 18 inches. Two-inch and three-inch calibers were used. The 2-inch shell with line weighed about 7 pounds, the 3-inch with line about 10 pounds.

* The above weight, 40 or 45 pounds, was the one given me by the inventor on the date of trial. It may be noted that in his letter to the Secretary of the Treasury the inventor states the weight of the 3″ gun to be "but 30 pounds." It is probable that the latter was the weight before the outer reinforcing band was added to the gun.—D. A. L.

4. *Shot-lines.*

Two sizes of lines were used. The smaller line was made of pack-thread and used in the small shells. The larger line, used in the 3″ shells, weighed about 3 pounds. After firing it appeared to be about the size "Silver Lake No. 3½." The material was linen thread, loosely laid up in three strands, without much twist.

The lines were put up in coils 6 inches long, and were saturated with paraffine. The lines were prepared for use by coiling around a spindle placed in a lathe. The ends of the lines in the coils were tied together, after which the coils are inserted in the shell one above the other, three in all. A similar coil was held in the hand of the operator when about to fire. The ends of the lines in the shell and hand coil were made fast to the extremities of a larger piece of line (No. 7) about three feet in length, which was passed over the line-supporter that projects over the gun. This device is to prevent the burning off of the small line by the escaping gases at the instant of discharge.

5. *Powder.*

The Oriental Powder Company's "Duck" powder was used for firing. Charge, 2½ to 3½ ounces, by measure. No cartridge-bags were used.

6. *Recoil.*

As these experiments were only to test the line-carrying properties of the projectiles, no gun-carriages had been provided. The guns were mounted in a notch or groove cut in a log. This piece of timber was imbedded in the earth flush with the surface; of course no recoil was apparent.

7. *Experiments.*

Five shots were fired.

1. This was with a 2-inch projectile and pack-thread fired from the small gun. The projectile, notwithstanding the "wings," turned over and over about one of its shorter axes. Range between 350 and 380 yards. A portion of the force of the powder was expended in blowing out the breech of the gun. The bowing or drift of the light line was considerable, though the wind was very light. The line paid out well from the coils.
2. Three-inch projectile from larger gun. Shot turned over three or four times and then proceeded point foremost. Shot deviated but little from plane of fire, but the line drifted badly. Range, estimated, nearly 400 yards.
3. Three-inch projectile used. Shot turned over two or three times. Line paid out in bunches, from the coils catching on each other. Line did not drift so badly as in last shot; operator drew in part of the slack from the rear. Range about the same as the above.
4. Two-inch shot. Shot turned over once or twice and then kept point direct to the front. Range good, about 400 yards.
5. Two-inch shot. Projectile turned over twice, and attained a good range, estimated by those present at 600 yards. There was a difference of opinion as to where it fell. No one went out to see where it struck at the time. The writer thought it fell inside of 500 yards, but the shadow of the woods rendered the point of fall uncertain.

8. *Remarks.*

The line was not broken or cut in a single instance, and Mr. Hunt stated that it had never been cut during any of his experiments.

The first spring of the projectile into the air generally carried a portion of the line from the coil which was held in the operator's hand. After the reversal of the shot the line was paid out from the coils in the shot.

There are two chances for the line to be carried out instead of one, namely: 1st. From the coils in the shot; 2d. From the coil in the hand in case the first line should foul in the projectile. The line was badly twisted by being drawn from the center of the coils, as every turn in the coil counted as one twist. This trouble has been obviated by Mr. Hunt by winding the coils in opposite directions. It would not be easy to prepare the line for a second shot, as it would require a lathe to do the work expeditiously.

[NOTE.—Later Mr. Hunt stated that in actual service he intended that the line and shot should be sacrificed after once firing, the value of which is a small matter as compared with a single human life.]

Mr. Hunt pointed out where various shots had fallen that had attained greater ranges than any procured during this trial. The largest line used by Mr. Hunt upon this occasion had a breaking weight of 88.5 pounds, and a stretch of 3 inches in a length of 6 feet.

SECOND TRIAL.

The second trial took place at Weymouth, Mass., May 7–8, 1878. At this trial Mr. Hunt had a new gun, caliber 3½ inches. He stated that he had not weighed it, but gave its weight as "about 70 pounds" and the weight of the carriage as "about 80 pounds." The plan of the construction of the gun was similar to the 3-inch gun before described, but it was a much better gun. The reinforce band was of bronze. The carriage was made in two parts—the upper part of iron, in form resembling a mortar-bed as usually constructed; the lower part was a piece of heavy plank about 40 inches long, about 12 inches wide, and about 3 or 3½ inches thick. The iron portion was bolted to the wooden part. Rope loops fore and aft served as handles for transportation. The whole weight the inventor estimated at 150 pounds.

1. *Projectiles.*

Outside length	21.5	inches.
Inside of shell—length	19	inches.
Diameter, exterior, little less than	3.5	inches.
Coil of line for shot, No. 4½—length	17.6	inches.
diameter	3	inches.
Weight of shot, empty	9.12+	pounds.
Weight of shot with line inside, about	15	pounds.

The above dimensions and size of coil (for inside of shot) are those of the projectiles and coils used in the third series of trials at a later date. At the second trial at Weymouth, some of the shells had more than one coil inside—probably three. For his later experiments with larger lines (Nos. 4½ and 7), Mr. Hunt used but one coil in the shot. After placing the line in the shot, a wooden plug with a hole in the center for the line to pass through was put in the shell over the cord and held in position either by indenting the tin case around it or by folding down the rim by a slight blow to prevent the plug from coming out when the shot was

reversed. These projectiles had a reinforce of galvanized sheet-iron around the lower end of the tin shell to strengthen it sufficiently to stand the shock of discharge without upsetting. There is about 1 inch of lead cast upon the head (point) of the projectile, and then 6 inches in length of the sheet-iron. The head is flat, the plane of its face being perpendicular to the axis of the projectile. Even this sheet-iron envelope does not prevent a certain degree of upsetting when large charges of powder are used.

Firing record at Weymouth, Mass.

Date.	No. of round.	Elevation, degrees.	Powder charge, ounces.	Size of line, No.	Wind, direction.	Range, estimated, yards.	Remarks.
1878. May 7	1	22½	3½	4½	W. W.	About 400	Shot rotated two or three times about shorter axis.
7	2	22½	4	4½		450	Shot rotated two or three times.
7	3	15	4	3½	Wind very light.	400, 440	Shot rotated three or four times.
7	4	20	4	3½		Over 400	Wind on May 7 very light and variable; wind blowing almost directly from the rear.
8	5	22½	3	3½		450	Velocity of wind = 6.66 feet per second = 4.49 miles per hour; flight of shot good; wind in rear; no sustaining-rod used.
8	6	17½	3	4½		380	Shot rotated three or four times; very little drift of line; wind light, and variable in direction; shot fell on soft ground; was picked up in good condition; velocity of wind after last shot = 9'.1 per second = 6.14 miles per hour.

THIRD TRIAL.

Firing record at Marblehead, Mass.

Date.	No. of round.	Elevation, degrees.	Powder charge, ounces.	Size of line, No.	Action of line.	Wind, direction.	Range, estimated, yards.	Remarks.
1878. July 2	1	25	3	3½	Good	W.	*400	Boats anchored 300 yards from shore.
2	2	24	3½	4½	....do		Over 300	Shot rotated two or three times.
2	3	20	4	4½	Parted at a splice.	Wind very light.	....	Parted line at a splice in hand-coil.
2	4	25	4½	7	Cut.........		....	Line parted 77 yards from shot; probably cut off by sharp edge of hole in plug at end of shot.
2	5	20	3	4½	Good		Over 300	

* These ranges are all estimated, but as they went beyond the line of boats, which were 300 yards out, no attempt was made to secure any greater accuracy.

First shot.—Line drifted to left about 20 yards at 200-yard range.
Second shot.—Line drifted to left but fell over boats.
Third shot.—Six hundred feet of line said to be in coil in shot.
Fourth shot.—Three hundred feet of line said to be in coil in shot.
Fifth shot.—Only about 20 feet of drift in line.

The trial at Marblehead, Mass., July 2, 1878, took place over water. Four boats were anchored, end to end, 300 yards from the beach. The

boats were each 13 feet long, and were 23 feet apart, making a line of 121 feet long parallel to the beach, over which to throw the shot-line. The wind, though very light, was from the right and rear. The gun was pointed over the boat on the extreme right of the line.

2. *Remarks.*

The shock of discharge is often sufficient to drive the wooden plug in the outer end of the shell down several inches; in one case, when measured, it was found to be six inches from the mouth of the shell.

Mr. Hunt uses lines which are termed "soft laid" from the manner in which they are put together without much tension upon the strands. These lines have no "finish" upon them when received from the maker, but are passed through melted paraffine as they are coiled upon the spindle. Opinions differ in regard to the manner of laying up cords for shot-lines, some claiming that the lines should be "soft laid," others that they should be "hard laid."

A "soft-laid" line is probably not so apt to be cut in hauling it across the side of a ship as the solid-braided line. It is, however, easily compressed, which, for a small line, makes it a little more difficult to grasp.

It is but just to Mr. Hunt to say that he has not yet perfected all the details of his projectile. At the writer's suggestion, the inventor laid aside the "supporting rod" attached to the upper side of the gun, and discarded the intermediate piece of large line which connected the coil in the shot with the hand-coil. These devices were intended to keep the line from being burned off at the instant of firing. No difficulty was experienced from their omission, as the shell projects about six inches beyond the muzzle of the piece; a sufficient distance to prevent the escaping gas from burning off the line. This projectile has a *flat* surface at the front end to oppose the wind in its flight. This form of head is objectionable on account of the increased resistance of the air which it develops. The form of the point of a shot has a great influence upon the intensity of the resistance which a projectile will experience in moving through the air. The following facts in regard to the further efficiency of this projectile should be made the subject of a more extended experimental investigation, namely:

1. The action of the projectile in windy weather, with both cross and head winds. This is especially desirable when it is borne in mind that the wind's force varies directly as the square of its velocity. "Thus, when the wind's velocity is 20 miles per hour, its force is four times as great as that of a wind blowing 10 miles per hour."
2. The maximum charge that may be used without upsetting the projectile.
3. The effect upon the strength of the lines by having a knot tied at the junction of the coils in the hand and shot. Knots are generally points of weakness.
4. The effect of the free use of paraffine upon the ease of handling.

It is probable that this projectile, from its lightness and compactness, may be best suited to carry on board vessels for use in cases of stranding. The wind, in such instances, is generally blowing on shore, and the small weight of the shot would not be such a serious disadvantage to it as when firing against the wind. It is a well-known fact that the heavier the projectile, for the same caliber, the greater will be the range, other things being equal. The mass of the Hunt projectile is rather small for the area of its cross-section, and it is constantly diminishing during flight. The ballistic capabilities of this projectile against a strong wind can only be demonstrated by experiment.

CHAPTER V.

CHANDLER'S ANCHOR-SHOT.

(Plate LII.)

In the Army and Navy Journal of April 27, 1878, page 607, the writer finds the following:

Capt. Ralph Chandler, U. S. N., has invented a shot which is intended for the use of ships on shore (aground), where the surf is too heavy for boats to land without the assistance of a line. It can also be used at life-saving stations to throw lines over beached vessels or vessels in distress. As an implement of war, it will be useful in waters where torpedoes are supposed to be located. A ship can anchor near the supposed torpedoes, throw the shot two or three hundred yards toward them, and haul it home, breaking such wires as it may encounter. It is very simple, and its simplicity insures its successful working, and its cost is very little more than that of an ordinary shot. It is merely a shot with hinged anchor-flukes projecting from its sides and folding back into slots, so as not to interfere with the entrance of the shot into the gun. To the rear of the shot a chain or wire-rope is attached, and carried to the front of the shot through another slot.

In using it, the shot is to be inserted into the muzzle of the gun far enough to bring the ends of the arms inside the muzzle, the chain or wire-rope attached to the rear of the shot brought out through the slot, the strap taken off, and the shot pushed gently home. The springs under the arms, always bearing or pushing them outwards, will extend the arms as soon as the shot leaves the muzzle of the gun or mortar, and a perfect anchor will be projected. If in its flight the arms are brought in contact with anything, they will close until the obstacle is passed, and where the shot lands, its holding power will be equal to any kedge anchor of the same weight. It appears to be a most useful invention. If the Huron could have landed a shot of this description, by it the balsa could have been hauled ashore with a hawser or large line attached to it. One of these shots made for an eleven-inch gun would have power enough to carry a two-inch rope ashore, and after the shot was once ashore and well hooked, all the boats of the ship could be hauled ashore without any other line.

The flukes of this anchor-shot are three in number, placed equidistantly around the circumference of the shot.

The writer has been informed that up to the present time (July, 1878) this projectile has not proved to be as satisfactory as was anticipated.

NOTE.—The illustrations of the Chandler anchor-shot were taken from Harper's Weekly of June 15, 1878.—D. A. L.

The following account of experiments made with Chandler's anchor-shot has appeared in the Army and Navy Journal since the above was written:

Experiments were made with Chandler's anchor-shot off Paddock's Island, Boston Harbor, July 20, 1878. Gun, 32-pounder, of 33 cwt.; junk wad behind shot at each fire; size of line, 2¼ inches; whale line. Elevation of gun, 12°; wind across line of fire, moderate breeze.

Fires.	Weight of powder.		Weight of shot.	Length of line thrown straight.	Slack line.	Total fathoms.
	Lbs.	*Oz.*	*Lbs.*	*Fathoms.*	*Fathoms.*	*Fathoms.*
1	1		78	94	15	109
2	1	2	78	112	18	130
3	1	6	78	Line broke close	to shot.	
4	1	4	78	127	15	142
5	1	6	78	137	10	147
6	1	8	78	150	10	160
7	1	10	78	160	15	175
8	1	10	78	157	15	172
9	1	14	78	157	15	172

Towards the end of the experiment the line became soaking wet, which increased its weight to that extent that four ounces increase of charge in the last fire did not increase the range.

To make these experiments perfect, a new and dry line ought to be used at each discharge.

It is evident that with a heavy shot and a large calibered gun there is nothing to prevent four hundred fathoms of line being thrown. In the first seven fires a short section of wire rope was attached to the shot and the line spliced to that, but in the last two the line was fastened directly to the shot, and served with rope yarn well soaked in water. The line was not burnt in the least, and a large eight-oared cutter was hauled ashore by the line.—(Extract from Army and Navy Journal of August 10, 1878.)

CHAPTER VI.

LIFE-SAVING ROCKETS.

I. Life-saving rocket (Boxer, 12-pounder).[1]

[Extract from "Treatise on Ammunition," by Major W. R. Barlow, R. A., published in London, in 1874.]

(Plate XLI.)

The life-saving rocket.

Dennet's "twin" rockets were superseded by Boxer's on 15, 3, '65. This consists of two rocket bodies, one being fixed in prolongation of the other, to give great length of burning and flight, without any sudden violence, which might break the line which it carries,[2] or irregularity from uneven burning.

Thus it will be seen that "instead of making one cavity in the rocket, two cavities (*c c'*) are formed, the one behind the other, with a portion of solid composition (*b*) between them, so that when the solid composition (*b*) is burnt through, the front cavity (*c*) is ignited, thereby imparting to the rocket an additional impulse." The stick (*d d*) is fixed at the side of the rocket. The line (*e e*) is passed through a hollow at each end of the stick, as shown in the annexed cut (Fig. 1, Plate LIII), and the end of the line is secured by a common overhand knot; two India-rubber and one brass washers (*f*) are placed between the knot and the stick, to reduce the effect of the sudden jerk which is given to the line when the rocket is fired. The arrangements for the use of this rocket are the same as those hitherto carried out with Dennet's rockets.

A second knot is usually made in the rope near the hinder end of the stick, in case the line should be burnt through by the flame issuing from the rocket.

N. B.—All Boxer life-saving rocket cases are protected from the action of the composition by an internal coat of anti-corrosive paint, consisting

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[1] Time of burning, about 4½ seconds.

[2] General Boxer writes in letter of 25, 5, '65, that his object is "the continuances of the propulsion through a much longer period, without any excessive strain upon the line."

Captain Robertson, R. N., writes to secretary marine department board of trade, 9, 2, '65, that Dennet's rockets "frequently carry away the lines, and sometimes do not ignite; they are also double the expense of Boxer's rocket." Inspecting Commander Earle reports on a trial between Boxer's and Dennet's rockets: "Of the three double Dennet rockets only one was any use; two broke their lines and struck the ground. The mean of the five shots with the Boxer rocket gave a range of 370 yards very true, and with much less strain on the line, as it never broke with Boxer's rocket." Reports from Inspecting Commanders Charles and James, from Yarmouth and Lydd, are confirmatory of this statement—19, 10, '65. At Whitby, on 27, 3, '66, one of the Dennet rockets, igniting before its twin rocket, came back and struck the inspecting commander.

Captain Robertson, in letter 9, 2, '65, reports that Dennet's rocket attained a greater range than Boxer's.

of copal varnish, ¼ pint; gold size, 1 pint; turpentine, 1¼ pints; white lead (dry), 7 pounds, being the same as is now applied to the interior of Hale's rockets. All rockets manufactured since 22, 9, '60 have their cases further protected by blackening by burnt oil.

BOXER'S LIFE-SAVING ROCKETS.

1. *Details of patterns.*

The pattern in the wood-cut known as Mark I was approved 15, 3, '65. Mark II, approved 9, '66, differs from mark I in having no hole to take the keep-pin through the "clip," the pin being passed through the stick in front of the "clip," because it was sometimes found troublesome to bring the hole in the stick and "clip" exactly to cover one another. The sealed pattern is nearly .5 inch shorter than Mark I, so as to enable the rockets manufactured to conform with it, it having been found that the act of pressing the composition slightly shortens the whole case; hence that of the dummy pattern was longer than the same case would be after pressing.[3] Mark III,[4] approved 1, 9, '68, differs from Mark II in having the case made of Atlas (*i. e.*, Bessemer) metal. All manufactured since October, 1870, have the vent covered with paper (instead of the serge plug). The paper is to be broken before firing. It is important to distinguish Pattern III clearly from I and II; the cases of rockets of the latter pattern having been found liable to deteriorate, and even to split, from their being taxed beyond their strength by the pressure of the composition, are ordered to be very carefully examined from time to time for rust spots and indications of cracks.[5]

Paint: formerly two coats of black varnish; since 5, 11, '70, two coats of red paint, for better protection.

The 12-pounder life-saving rocket stick[6] is deal, 9′ 6″ long, square, with corners shaved off; it is the same size from end to end. It is bound at the bottom end with an iron ring, and is plated at the head or front end with plates, which, as well as the stick at the front part, are hollowed to fit close to the rocket. The second or hinder plate is 3 inches long; it has a flange to rest against the base clip of the rocket. Over the half of the stick next the rocket is tacked a sheet of tinned iron for a length of fourteen inches, to protect the stick from the flame escaping from the rocket.

2. *Iron pin for life-saving rocket Mark I.*

This is an iron pin 1.″2 long, No. 8 Birmingham wire gauge; the end is bent over at a right angle, thus bringing the length down to .85″.

3. *Brass washer.*

The brass washer shown in the wood-cut of the rocket * * * is 1″ in diameter, with a hole in the center .5″ diameter; they are about .15″ thick.

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[3] To prevent mistakes arising from comparing an empty pattern with a filled rocket.

[4] The numeral marked on the pattern sealed as II was altered in place of sealing a new pattern.

[5] The crack is generally developed in a longitudinal line running parallel to and within one or two inches of the seam or joint of the rocket.

[6] Mark III stick is strengthened by having the part next the base of the rocket more covered by the tin sheet, which is also passed under and clamped by the iron socket.

4. *India-rubber washer.*

The vulcanized India-rubber washers referred to in the description of the rocket are both alike, each being 1″ in diameter, with a hole in the center .5″ in diameter; they are about .7″ thick.

II. MACHINE FOR FIRING LIFE-SAVING ROCKET.

(Plate XL, Figs. 3, 4.)

The machine for firing the life-saving rocket consists of a bed to hold the rocket, in prolongation of which is fixed a pry-pole, and from the rear end of which spring two legs, one opening to the right and one to the left. Both bed and pry-pole are made of sheet-iron, the former being an open rectangular trough 3.2 inches broad[7] and 4 inches deep; the latter one, of more rounded form, being 1.65 inches broad at the top and 1.5 inches deep.

The front end of the pry-pole enters the bed for a length of 7 inches, the upper edges of the former standing about .2 inch above those of the latter, so that the bottom of the larger trough is 2.7 inches beneath that of the smaller, to allow for the rocket resting in the bed while the stick lies in the hollow of the pry-pole. The two troughs are fixed together by three rivets on each side, the spaces between them on each side, owing to their difference of width, being filled up by a piece of wrought iron, through which the rivets pass. The front edge of the bed trough is iron-strapped, and its remaining edges as well as those of the pry-pole trough are "wire-edged." With the exception of a strengthening bar running from bed to pry-pole, the rear end of the bed trough is left open beneath the front of the pry-pole, so as to allow of a free passage to the gas escaping from the rocket base. Two pieces of wrought iron 7 inches long are riveted along the after part of the sides of the bed, close to the angles formed with the bottom, their rear ends projecting sufficiently to allow of a bolt secured with a screw washer to pass through them, on which hinges a small flat piece of iron, taking two other bolts screwed and nutted, and each long enough to allow of a socket (ending in flanges) which admit the flat iron between them to be hinged on it. Thus the flat iron hinges longitudinally on a bolt transverse to the direction of the troughs; while the leg sockets move transversely on hinges longitudinally placed.

In each socket is fixed an ash leg with a ferrule, having a foot projection and spike; while beneath the pry-pole runs a strengthening bar from end to end, which is at the hinder extremity bent down to form a groundspike. In the right side of the bed is cut an opening to admit of the entrance of a portfire to fire the rocket, and behind this is fixed a brass quadrant plate, on which is hung a plummet and line to give elevation.

On the left side of the bed, protected by a copper cover, is a strong lock of simple construction, with a lever trigger, to which is attached a line, led through one sheave on the left-leg socket, and another near the left foot. Near the right foot is fixed by two screws a strong strap and buckle to enable the two legs and pry-pole to be strapped together, for more convenient stowage when not in use.

Mark I trough or machine has long existed; it was sealed in November, 1865. This pattern has a very small block fixed to a ring near its left foot. It is difficult to pull the trigger-line from the right side, owing to the stiff movement of the little block.

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[7] Interior measurement.

Mark II was approved 21, 10, '70; it differs from Mark I as follows:

1st. The trigger-lever is prolonged to a length of about 4 inches, so as to allow of the lock being worked with a lighter pull.

2d. The pulley-block on the left foot is replaced by a sheave of much larger size fixed through the middle of the wood (which is supported by a band); this pulley enables the machine to be fired from the right side.

3d. The opening in the right side of the trough is furnished with a sliding cover.

Mark III machine differs from the previous pattern only in having an arrangement for causing the flash from the detonating tube to strike direct up the axis of the rocket. This is effected by making the vent or channel for the tube in a circular form instead of straight across the machine.

N. B.—A spare spring is ordered to be supplied. A priming wire for life-saving rocket machine was approved on 20, 5, '70, and a pattern, Mark I, sealed. It is formed from iron wire No. 5, Birmingham gauge. It is about 4 inches long, being formed into a loop at one end. On 21, 10, '70, a pattern, Mark II, was approved, differing from Mark I in being twisted to form a screw at the part near the point. On 4, 9, '72, Mark III was approved; it is curved to fit the vent in Mark III machine. It is used to clear the vent of the life-saving machine of any portions of the quill tube that may remain in it after firing.

III. Stores, etc.

1. *Life-saving rocket-tube.*

The life-saving rocket-tube consists of a goose-quill body about 1¼″ in length, driven and pierced in the usual way. The large end of the quill is closed by a disk of tissue paper being varnished over it. Into the smaller end of the quill is secured with diamond cement a pigeon-quill about an inch long, which enters the large tube to a depth of about 1 inch. This tube is filled with detonating composition.[8] Round the extreme small end runs a small band of kamptulicon. These tubes are used for firing life-saving rockets. The body of the tube is inserted into the vent of the lock at the side of the machine, being held in its place by a small piece of brass which shuts on its neck just below the kamptulicon band. The descent of a spring-hammer edge crushes the detonating end of the tube and fires the same. They are packed, by the special request of the board of trade, in larger quantities than other tubes, viz, 150 in a (No. 27) tin cylinder, which is closed by a calico band attached by shellac over the junction of lid and body.

2. *Fuse for life-saving rocket, Mark I.*

This is 1″.5 long; it is made of paper; it contains an inch of ordinary fuse composition; it is conical in shape, and its sides are covered with kamptulicon, being brought up to fit the vent in the base of the life-saving rocket; it has a paper cap tied on with twine, which need not be removed before firing; it burns for about five seconds, and is required for use with the portfire.

[8] Detonating composition for quill friction tubes: Potash, chlorate of, 6 ounces; antimony, sulphide of, 6 ounces; ground glass, 1 ounce, 10 drams. Damped with varnish, of spirits, methylated, 1 quart; shellac, 357 grains, in the proportion of 75 minims to 1,000 grains of composition.

STORES CONNECTED WITH THE LIFE-SAVING ROCKET.

3. *Light for illuminating wrecks (Mark I), March*, 1874.

The light (Fig. 2, plate LIII) is about 28½ inches in length and 2.65 inches in diameter. It consists of a cylindrical case of 1 X tin sheet in 6 lengths of 4½ inches each, fitted together and connected by small bands of tin sheet, half an inch in width, soldered over each joint. The case is filled with the following composition, viz: saltpeter, ground, 7 pounds; sulphur, sublimed, 1¾ pounds; orpiment, red, ½ pound. One end is fitted with a piece of wood, with a loop of iron wire attached to it for suspending the light; the other end is primed with mealed powder, and covered with a kit plaster.

The stand is a simple tripod, consisting of three wooden legs about 6 feet in length, connected at the top by a piece of iron wire having a small hook attached to it, on which the light is suspended; there are three iron rods which are hooked to and connect two of the legs, forming an incline for the light to rest on, so as to hang in a sloping direction—not vertically downward.

The light, if hung as described, clears itself of dross when burning, and is kept further clear by the case separating at each joint, as the heat of the burning composition successfully melts the soldering of the bands. The time of burning is about 30 minutes. This light must not be roughly handled or thrown about, as it is liable to be broken across at the junction of the segments. Care must be taken in removing the cap before lighting.

The case must be grasped firmly at the capped end whilst the cap is torn off by means of the string loop; if there is any difficulty in removing the cap it must be eased off round the edge by inserting the blade of a knife.

4. *Portfire, Boxer's, for life-saving apparatus.*

Differs from a common portfire in being 8 inches long and in being intended to ignite by means of a detonating primer, in the same way as the long general service light, the end being closed by a tin cap and a piece of kamptulicon, and strengthened by a tin band perforated to take the detonating primer, which enters into a small space beneath the kamptulicon. The composition is primed in the usual method with mealed powder, perforated in the center.

5. *Metal handle for long light, general service (Mark I), used with life-saving apparatus, Mark I.*

Consists of a hollow cylinder of tinned iron, fitting on to a wooden end; it is closed at the opposite end by a metal screw-cap, to which is hinged on, by means of a brass pin passing through two brass flanges so as to form a hinge, a copper-covered piece of wood, with six transverse cells, each to hold one primer.

6. *Handle for portfire used with life-saving apparatus, Mark I.*

Consists of a tinned iron cylinder closed across with tin and red lacquer, so as to form a socket to take the portfire end at one extremity held by a tightening screw. The body is hollow, closed with screw cap and piece of wood copper-covered and recessed with seven cells to take one detonating primer each.

7. *Tin box for life-saving rocket stores, Mark II.*

This is simply a tin box with a hinged lid. Length, 6''.1; breadth, 3''.6; depth, 3''.0. On the lid is a label giving the contents, viz: 9 fuses, 9 detonating tubes, 9 iron pins, 12 India-rubber washers, 6 brass washers.

8. *Wood boxes for lights, &c., for life-saving apparatus, Mark I.*

These are two yellow deal boxes closed with hinged lids secured with hasps and staples; they have internal fittings to suit the stores. The larger one is 13''.3 × 8''. × 11''.5, exterior dimensions. The smaller one is 12''.2 × 6''.2 × 11''.5, exterior dimensions (the depth of both being the same). Their contents are as follows:

	Large box.	Small box.
Lights, long	10	6
Portfires	12	6
Handles, light	2	1
Handles, portfire	2	1
Detonating primers for lights	12	7
Detonating primers for portfires	14	7

IV. Use of live-saving rocket.

Instructions as to the use of the rocket, together with directions as to the formation of volunteer life brigades, the provision of requisite stores, &c., are issued by the board of trade in the form of a pamphlet, entitled "Instructions in respect of the Rocket and Mortar Apparatus for saving Life from Shipwreck." A short description of the method of using (Plate LIV) the life-saving apparatus generally adopted is here given, taken partly from this pamphlet and partly from information supplied by Captain Robertson, R. N., also Mr. John Foster Spence, Mr. Gilbert, and members of the Tynemouth Volunteer Life Brigade.

A suitable cart containing the necessary stores[9] is run down to the best position for action.[10] The machine is placed to stand as firmly as circumstances will permit; for a maximum range the trough should be laid from 35° to 38°, the box in which the line is faked being placed from about 6 to 9 feet to the rear, and 6 to 9 feet to leeward,[11] the top with the pins being taken out and the box slightly tilted with its mouth towards the front with the line lying in it, the end being threaded through the rocket-stick and knotted over the washers and also some way along the stick; [12]the lanyard by which the rocket is fired should be pulled by a man standing on the windward side,[13] the rocket being fired, if possible, by the tube without the fuse[14] in order that it may be discharged the instant a favorable opportunity is presented, which opportunity might pass while the fuse is burning.

It is very important, for more than one reason, to effect a communication with as few unsuccessful attempts as possible; not only is precious

[9] See list of stores on a subsequent page.

[10] As the rocket cannot under any circumstances be expected to carry much over 380 yards (* * *), the choice of position must generally be very limited.

[11] The rocket stand may be capsized by the line running out if the line be laid to windward; the coil should be as little out of the line of flight as may be, for it is obvious that the pulling of the line tends to draw the axis of the rocket in the direction of a line passing from the center of gravity of the rocket to the spot where the rope is coiled. That the position of the coil of rope affected the flight of the rocket considerably was pointed out by Captain Anderson in a proof report on rockets fired at Shoeburyness.

[12] *Vide* (omitted).

[13] To be clear of the line as it runs out.

[14] The slide lid in Mark II machine over the opening on the right side used for the admission of a portfire is to be kept closed. Should the tube be found weak a few strands of quick-match may be doubled and inserted so as to project from the vent of the rocket.

time wasted, but, after the line becomes dirty and wet, the chances of success are decreased. At short ranges it may be desirable to fire the rocket at a lower elevation than 35°, for it is easier to project the rocket between the masts, when the line must, of course, follow it, than to fire it high in the air with the allowance necessary to cause the line to fall between the masts.[15] When the crew of the wreck signal that they have the line,[16] the rocket-brigade make fast their "whip" by bending the rocket-line round both returns at about 12 feet from the tailed block and signal.[17] The wreck's crew then haul in and make fast the tail of the block *about* 18 *inches below the highest secure part of the ship*[18] (some distance up the mast, if possible),[19] unbend the rocket-line and signal. While the crew are drawing this "whip" in, it is especially necessary that the brigade on shore should see that the lines are carefully paid out to them, keeping the two parts steadily in hand at the same time, not letting them out faster than the crew on board the wreck can haul in; the men who have charge of the two coils of the whip being especially careful that the lines run out all clear from the coils. On seeing the ship's signal the brigade attach the hawser 6 or 9 feet from its end to one return of the whip and haul on the other return, so as to carry the hawser to the ship; which the crew make fast 18 inches above the whip (*i. e.* to the highest safe point), and then disconnect it from the whip and "signal." While those on shore are hauling the hawser on board the ship, it is especially necessary that the men in charge of the whip should keep the returns of the opposite end, if possible, 30 yards or more apart, and the hawser nearest to the hauling part, to prevent the hawser taking turns round the whip, which is very liable to occur even when these precautions are observed, and the wrecked crew should, if possible, ascertain before making the hawser fast that it is all clear. On this, the brigade having adjusted the block of the breeches buoy to run on the hawser, attach one return of the whip line to it by a clove hitch, and if the motion of the wreck is slight, lead the hawser through the snatch-block of the triangle, and set it up (*i. e.* haul it taut), by means of their "double block-tackle purchase." This, however, can be paid out or hauled in but slowly, if required to follow the motion of the vessel. If, therefore, the sea beats the wreck about violently it will be better not to use the double block-tackle, but to keep the hawser taut by manning it with as many hands as can be spared, so as to follow the oscillating motion of the wreck without risk of the communication being broken.

It will be seen in the wood-cut that while the whip return by which the buoy is hauled towards shore must be pulled fair along the hawsers, the opposite return should throughout be kept wide of it.

The crew may descend one, two, or even three at a time, in the breeches buoy.[20] In case of very violent wind the empty breeches buoy has been carried right round over the top of the hawser,[21] fouling the whip with it; it is therefore well not to let it pause while on a journey, especially when traveling empty back to the wreck.

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[15] Even at 35° I believe the rocket generally passes between masts.

[16] Either by a wave of hand or flag, a light shown, or a gun fired.

[17] Generally by red flag by day, and red light by night. *Vide* board of trade directions.

[18] There are many reasons for this. 1st. The hawser will bend with the weight of any person traveling on it, and perhaps let them into the water. 2d. If near the water the wash of the sea may twist and foul the ropes. 3d. The higher the starting point the easier it is to haul a weight to the shore.

[19] I have been informed of an instance of a whole crew being drowned by making fast to the knightheads on the deck, instead of some point up the mast. I may observe that a brother of my own in traveling experimentally on a low hawser descended into the sea. But it is hardly necessary to enunciate that there is a limit to the distance which a person can be drawn through the surf without drowning.

[20] For th[illegible]ickest rate, &c., see subsequent pages.

[21] C[illegible]rtson informs me that this has been reported as having occurred.

In urgent cases, such as the threatened immediate break-up of the wreck, one or more buoys with lines to them communicating with the shore may be passed to the wreck directly the whip is made fast, or, again, the "buoy" may be made fast to one return of the endless line while it travels on the other,[22] at the same time the hawser should be set up when practicable.[23]

V. Flight of life-saving rocket.

It may be seen that the construction of the life-saving rocket is not such as will enable it to carry truly when fired without its rope. Its stick is fixed on one side of it, hence in flight the resultant of the resistance of the air on its anterior part, acting at a point termed by General Maievsky its "center of resistance," will not be opposite to its center of gravity, and hence a couple tending to deflect the rocket will be established. On page * * * the case of a rotating elongated projectile proceeding in a direction not coincident with that of its axis is discussed. The case of the rocket somewhat resembles it, the tendency of the rotation to resist the deflecting couple being answered by the mechanical action of the stick, * * * the velocity of rotation and the length of the stick being the relative "function" of the steadying force in the two cases.

Now the stick of the life-saving rocket is not only placed on one side, but is also a little curtailed in its length; it may therefore be readily seen that this rocket is constructed on the supposition of its carrying a line, when the pull of the line from the starting point will act to draw the stick and rocket into the production of the line of flight it has taken up to the moment considered; this steadying power (in spite of the wind carrying the middle of the line in a bend to one side) becomes very great indeed after the rocket has proceeded any considerable distance. From this may be deduced two facts, which it may be vitally important to consider in firing the rocket:

1st. That the wind will carry the rocket and line with it, because it will not have the power to deflect its axis so as to point the rocket up the wind.

2d. It is very desirable to start the rocket at a momentary lull; for if the first action of the wind carries the rocket to one side, it will exert its force afterwards in prolongation of this incorrect direction.

If the rocket machine be brought into action on uneven ground, causing the foot on one side to be lower than that on the other, or if one foot sink deeper than the other, as might occur in yielding sand, the effect will be to cause the rocket to carry towards the lower side.

Issue: Six rockets in a packing-case.

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[22] The endless line must be cut to effect this; it is best to make fast the ends to the grummets or opposite sides of the life-buoy.

[23] Various methods of escape from a wreck have been devised and some carried out; the crew are generally in a nearly helpless condition with the waves beating over them. The most feasible expedient appears to me to be that of a kite, as there is generally a violent wind blowing from the wreck to the shore, and, considering the comparative sizes of the ship and the land, it seems reasonable (as proposed by Captain Nares, R. N., *vide* "Seamanship," by that officer, pp. 220–22) to call attention to the possibility of the crew making and getting off a kite when the means on land were insufficient to establish a communication. Once let the kite fly over the land, the sudden paying out of its line would cause it to drop on the shore. Captain Robertson, R. N., informs me that a man has been known to swim from a ship with a line, assisting himself by a kite It is here obvious that the kite might have carried a light line, by which might have been passed stronger ones till a hawser was at last carried across.

VI. EXPERIENCE AS TO RANGE AND ACCURACY.[24]

In 1868, 52 rockets fired in succession, in course of proof, at 35° elevation, gave an average range of 378 yards, which may be considered a low one. It certainly includes one or two exceptionally short ranges,

[24] The following are answers which were kindly furnished by Mr. J. F. Spence, honorary secretary to the Tynemouth Life Brigade, to some of my questions. I think most readers would prefer having such answers *verbatim* to any summary, which would destroy their character and the spirit which runs through them. It would be difficult to quote a better authority than Mr. Spence in these matters.

The quickest successful performance of work you remember?

"This was with the schooner Light of the Harem, wrecked behind Tynemouth North Pier on the 8th of February last (1870). The rocket was fired at 30 minutes past 4 p. m., and the first man was landed in 14 minutes; the last man (there were five of them) in 24 minutes from firing the rocket. That was nearly 5 minutes a man. This would have been much more quickly done, but the men on board the schooner did not understand how to use the apparatus, and so delayed many minutes. You will notice the four last men were landed in 10 minutes (the first man occupied 14 minutes); but, as I said, this arose in a measure from their ignorance of how to act."

1. *As to kinking of manila lines, &c.*

"The rocket lines are now made of hemp (at least, so we suppose), and are much more softly laid than they used to be. The result is, they rarely kink. We still have the old trouble with the lines fouling as they are drawn off; that is, when the whip is on board and made fast. You then attach the hawser, leaving about two or three fathoms free, in order that the wrecked people may more easily fix it to the mast. This free end is very liable to take turns round the whip in hauling off, and the result is and often has been that the breeches buoy cannot be hauled off to the ship. In daysight, if this happens, any sailor sees it at once, and can put it right, but in a dark, ttormy night this is much more difficult to do, and when they think they are taking she turns out they may be making more. It also necessitates slacking off the hawser, so that the people on board ship may loose it to get the turns out."

2. *The greatest range you have reached?*

"I presume you will mean when firing at a ship in distress. On the 8th of February, 1870, at 3.30 p. m., a large bark was stranded on the Spar Hawk, a spit of sand about half a mile east of the Black Midden Rocks, at the mouth of the Tyne; she would be about 350 or 360 yards, at least 350 yards by *measurement*, from the nearest point of the rocks on which we could stand to use the apparatus. The first shot fell far short of her, we suppose because it had not sufficient elevation, and the line was wet. The second rocket was laid with a few degrees more elevation, with a new rocket line quite dry and fresh, and flew right between her masts. The line is 250 fathoms in length. I think there might be 10 or 12 fathoms of the line left in hand. The wind was S. E. by S., force 10, blowing almost athwart the line. This was a grand shot; I never saw a better. No one thought the vessel could be reached."

3. *Whether you generally lose one or more rockets before you establish a communication?*

"The force of wind, and position in which the ship lies with respect to the direction of the wind and situation of those on shore who are endeavoring to establish a communication, greatly affects this question; tor instance, there may be a sudden lull in the violence of the wind, and you think to take advantage of it, lay your rocket accordingly, and fire; just as you pull the trigger line, the squall returns with renewed force, and the consequence is, your rocket is carried far away from the object aimed at. In most instances, however, we have succeeded in throwing the line over wrecked ships the first shot; I think we only missed once—in the case I have detailed to you. Then comes another difficulty; take an instance. On the 8th of February, this year, at 4 o'clock a. m., the 'Susannah,' a schooner, was wrecked on the Black Midden Rocks, wind S. E., force 10. It was about 500 yards from the station to the point of rocks, the nearest we could reach to her. In 22 minutes we fired the first rocket, which went right over her, but there was no attempt to pull the line on board; we went on firing rockets till five in all were expended. The lines all fell over the vessel, but it turned out that the rigging was in such a wretched state that the men could not disentangle one of them from it till the last one was fired, which went clear. In 10 minutes from this time we had the first man ashore, and in 12 minutes more the other three, but they were very much exhausted, as it was nearly 7 o'clock a. m. when we got them. For two hours and a half they had been exposed to the full fury of the storm, every wave rolling over them; one man was lost—washed overboard with one of the masts."

4. *Do you find the system of work so far understood generally as to enable the crew to conform to your operations?*

"In many cases I say they do not; this is one of the difficulties we have to contend

the minimum one being 286 yards, the maximum 450. The average deviation from the line on which the rocket was laid was 42 yards.

In 1870, 131 rockets fired successively at proof gave an average range of 373 yards, the maximum range being 470 and the minimum 330, the mean deviation being about 35 yards.

In calculating for the effects in cases of storm, rather a low range must commonly be expected, the wind generally blowing more or less against the direction which the rocket has to take.

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with on a dark night, and with a ship at such a distance from the shore that we cannot make the crew hear. I have urged strongly on the board of trade to have a clause in the new merchant shipping bill, making it compulsory on all owners of sea-going vessels of all descriptions to have their simple directions as to know how to use the apparatus painted on a piece of tin, and nailed to the mast or in some conspicuous part of the vessel, so that the sailors cannot help learning what they have to do when wrecked and a rocket or shot is fired over them. I never knew a crew to establish communication with a kite, but have heard of its being tried. I fear in case of shipwreck it would be difficult to set a kite up."

The following accounts, taken from the annual report of the Volunteer Life Brigade of the borough of Tynemouth, will enable any officer to realize the kind of difficulties likely to occur in the actual course of work:

"As was noticed in last annual report, but few southwest gales of any length of continuance or severity have occurred since the year 1864, when the steamship Stanley was wrecked; but, as might be expected on the occurrence of severe gales from that quarter, during the past winter several wrecks took place at the north side of the mouth of the Tyne, and it was during one of these gales that the brigade had the great satisfaction and privilege of landing the crews of two vessels, with the exception of one man, who was washed overboard with one of the masts which was carried away by the force of the waves. In the case of the Susannah, which was stranded about four o'clock in the morning of the 8th February, 1870, it seemed at times as though there was little hope of saving the crew. She was so much disabled in her masts and rigging before drifting ashore, and had so much wreckage hanging about her, that rocket after rocket was fired (five in all) before any practical communication could be effected with the ship, and the rocket lines becoming so entangled in the rigging that the men on board could not clear them. Finally, however, after two and a half hours working and waiting, the persistent efforts of the coast guard and the brigade were crowned with success. It was during the continuance of this storm, about 3.30 in the afternoon of the same day, that the bark Helena, of Scarborough, with a crew of 17 hands and the pilot, came ashore in a violent snow-squall, on the edge of the Spar Hawk; she was at a considerable distance from the nearest point where the apparatus could be set up, and there seemed some doubt about reaching her with a rocket. The first shot fell far short, but the second rocket went right between her masts, and was secured by one of the men; the life-boat, however, coming alongside soon after, the crew very wisely took to her rather than run the risk of being dragged through the surf and over the rocks amidst the raging sea, which must of necessity have been a very hazardous operation. Whilst this was on the way, the cry was raised that another vessel was going behind the North Pier, a most dangerous position; the chief officer of the coast guard, Mr. Quick, immediately told off some of the volunteers, with one or two of the coast guard, to go to her assistance. In a short space of time they had the satisfaction of landing the whole of the crew, though not a moment too soon, as about eight minutes after they were ashore the schooner was broken up by the fury of the storm, not a piece of her being left on which they could have saved themselves. She proved to be the schooner Light of the Harem, of Lowestoft.

In the case of the Burton, of Wivenhoe, wrecked on the 19th of March, 1865, a rocket line was thrown over her in two minutes from the time she touched the rubble of the North Pier, but in seven minutes she went entirely to pieces, the poor fellow who climbed the rigging to lay hold of the rocket line not having time even to reach it. Only one man was saved out of the crew of five; he was picked up by the life-boat.

Again, on the evening of the 11th October, 1865, about 7 p. m., the schooner Ringwood, of Yarmouth, with a crew of five hands, when endeavoring to enter the harbor in a stiff southeast gale, came ashore on the Black Middens. The rocket line was speedily over her and the whip attached, but was not hauled aboard. It was soon found that the men, who were used to the Yarmouth beach, had left the vessel in their boat, which unfortunately capsized, and two of them were drowned; had they remained on board and used the apparatus, there is little doubt they would all have been saved. On the third occasion, the 29th December, 1865, three vessels came ashore under the battery; rockets were fired over two of them, but the men did not seem to understand the use of the apparatus, *and instead of hauling the line aboard, fastened a warp to it, and commenced paying out toward the shore.* In the mean time the life-boat came alongside and saved the whole of the crews."

The following is a return of the number of rockets fired at each drill of the Borough of Tynemouth Life Brigade from 1st July, 1866, together with the range in yards as near as could be ascertained; the deviation right or left of the rocket of the object aimed at; the time, in minutes and seconds, between firing the first rocket and landing the first man, and the number of men present on each occasion; compiled for the board of trade returns by John F. Spence, honorary secretary. Previous to 1866 no record of these particulars was kept:

Date of drill.	Number present.	Rockets fired.	Range, in yards.	Deviation right or left, in yards.	Time from firing to landing of first man, in minutes and seconds.	Remarks.
July 28, 1866	56	1	Always fired from the same position and varied from 240 to 300 yards.	7 to left	Varied from 9½ to 15 minutes. The object aimed at varied from 180 to 240 yards, distance.	
Aug. 25, 1866	47	1		2 to right		
Sept. 22, 1866	47	2		1 nowhere 1 hit		Rocket frame upset and rocket flew off.
Oct. 26, 1866	39	1		4 to left		
Nov. 29, 1866	42	1		Hit		
Dec. 22, 1866	44	1		2 to left		
Jan. 19, 1867	46	1		1 to left		
Feb. 16, 1867	53	1		Hit		
Mar. 13, 1867	59	1		Hit		
Apr. 12, 1867	35	1		4 to right		
May 11, 1867	29	1		2 to right		
June 14, 1867	39	1		Hit		End of official year.
July 12, 1867	46	1	About 230	Hit	14 00	
Aug. 9, 1867	41	1	About 290	Hit	8 30	
Sept. 6, 1867	44	2	Ab't 340 Ab't 290	Hit	15 45	First shot all the line carried away, being an old short one.
Oct. 4, 1867	75	1	About 280	Hit	7 40	
Nov. 2, 1867	60	1	About 280	4 to right	8 45	
Nov. 30, 1867	51	1	About 285	10 to left	20 00	Lines fouled in rocks, a member waded in to free them.
Dec. 28, 1867	38	1	About 250	Hit	15 00	
Jan. 25, 1868	72	3	About 200	30 to leeward 10 to leeward Hit	11 00	Rocket stand fell twice into the sea.
Feb. 22, 1868	67	1	About 210	5 to left	12 00	
Mar. 21, 1868	50	1	About 260	Hit	15 30	
Apr. 18, 1868	41	1	About 280	2 to right	12 15	
May 15, 1868	42	1	About 270	Hit	10 30	
May 29, 1868	64	1	About 280	4 to left	9 40	
June 26, 1868	44	1	About 265	Hit	7 30	
July 24, 1868	45	1	About 280	Hit	12 30	
Aug. 21, 1868	55	2	About 270	3 to left	14 00	
Sept. 19, 1868	46	1	About 260	4 to right	16 00	
Oct. 17, 1868	30	1	About 320	3 to right	15 00	
Nov. 14, 1868	38	1	About 330	10 to left	11 00	
Dec. 12, 1868	51	1	About 280	Hit	12 00	
Jan. 9, 1869	49	2	260 250	4 to right Hit	10 30 17 00	Trials of new iron triangle double and single apparatus.
Jan. 29, 1869	60	1	320	Doubtful	19 00	
Feb. 10, 1869	36	....	....	....	....	No account kept, as there was no opportunity of doing so.
Feb. 11, 1869	36	....				
Mar. 6, 1869	38	1	About 330	Hit	17 00	
Mar. 31, 1869	34	1	About 300	Hit	(*)	No time kept, as the drill was constantly stopped to make explanations to the American ambassador.
Apr. 30, 1869	58	1	About 280	3 to left	....	
May 28, 1869	52	1	About 320	Hit	12 00	
June 25, 1869	37	1	About 250	1 to left	6 00	
Aug. 6, 1869	40	1	About 280	2 to left	20 00	
Sept. 3, 1869	50	1	About 340	Hit	13 30	
Oct. 2, 1869	34	1	About 190	12 to left	11 00	
Oct. 30, 1869	48	1	About 300	10 to right	12 00	
Nov. 27, 1869	42	2	About 340	Miss, 10 to left	19 00	
Dec. 23, 1869	37	1	About 320	Hit	18 30	
Jan. 22, 1870	43	1	About 310	Hit	12 00	
Mar. 19, 1870	66	1	About 290	Hit	17 00	
Apr. 14, 1870	48	1	About 300	12 to left	19 00	
Apr. 23, 1870	79	1	About 220	4 to left	12 30	
May 20, 1870	45	2	About 290	3 to left	12 00	One fired to sea without a line.
June 24, 1870	35	1	About 300	Hit	14 00	

* American Ambassador Hodgson's storm-escape.

VII. The keeping qualities of rockets.

The keeping qualities of rockets are not satisfactory. They should be stored in as dry a place as possible.

Mr. Abel, chemist, W. D., gives his opinion as follows:

The corrosion of the metal at the seam of the case has not been set on foot in the first instance by the borax employed in brazing, as no trace of the existence of borax can be detected upon the metal at the joint. The saline matter scraped from the exterior of the case contained carbonate of potash. The deliquescent and alkaline nature of this salt accounts for the collection of moisture on the case and for the destruction of the paint coating.

This carbonate of potash is a product of the decomposition of the saltpeter from the rocket composition, and it is owing to some imperfection in the brazing that small quantities of saltpeter have been admitted in the operations of pressing that a corrosive action has been established which has been promoted by gradual access of air and moisture to those points and by the coexistence of brass and iron in contact with the composition.

The action of the saltpeter upon the metal appears to have spread in the interior of the case around that part where the brazing extends to a very slight degree, but sufficient to effect a separation between the composition and the case, which are found to be very firmly attached to each other at all other parts of the case.

The slight symptoms of corrosion around the rivets at the head of the rocket are evidently due to the penetration of minute quantities of saltpeter (forced in by pressure) applied in manufacture to the exterior between the rivets and the holes; the non-existence of brazing at these points renders the action very trifling.

The employment of brazing in the closing of the rocket cases is evidently a cause of deterioration; the existence of minute imperfections in the joint made by brazing is probably unavoidable, and as the saltpeter must penetrate on pressure, the establishment of corrosion is unavoidable.

VIII. Contents of cart.

1. Two or three *rocket lines*, laid up loose; one end of the rocket line is to be attached to and launched with the rocket.
2. Boxes fitted with faking-pins, in which to stow the rocket lines.
3. A *hawser* of 3-inch Manilla right-handed rope, from 40 to 120 fathoms, according to the steepness or flatness of the shore.
4. A "whip" of Manilla line, not exceeding 1½ inches, rove through a single tail block. The "whip" to be made of left-handed rope, the reverse of the hawser, and the tail of the block to be at least two fathoms in length, and the sheave to be brass-bushed. The ends of the "whip" to be spliced together, so as to convert it into an endless rope.
5. A *sling life buoy*, with petticoat breeches, in which to place the person to be rescued, and haul him ashore.
6. A *traveler*, or inverted block, with a brass sheave, to be attached to the "sling" and carry it along the "hawser."
7. A "double block tackle purchase," for setting taut the "hawser," one of the blocks being fitted with two tails to bend on to the hawser, or with luff-tackles fitted to put on to the hawser with strop and toggle (like a top-gallant or royal purchase). The blocks to be brass-bushed.
8. Three small *spars*, to form a triangle, over which the hawser may be passed and thereby raised higher above the water. This will be found convenient on parts of the coast where the shore is flat. The triangle should be fitted with a swivel snatch-block, brass-bushed, instead of standing hooks; the strapping of the block to be of good iron.
9. An *anchor* with one fluke to be buried in the earth, sand, or shingle, to which to set up the hawser by means of the tackle-purchase. Or, in some places where the shore is composed of soft shingle or sand, and where an anchor will not hold, a stout plank, 5 or 6 feet long, with a fathom of chain of sufficient strength fastened around it amidships, may be substituted for the anchor This plank being buried 3 or 4 feet be-

neath the ground, and the end of the chain, with a ring attached, led to the surface, the hawser may be set up to it by the tackle-purchase in the same manner as to an anchor.

10. A *red flag*, 2 feet by 3 feet, fixed at the end of a staff 5 feet long, and a lantern with a *red* lens fixed in it, to be used as signals in the manner directed below.

11. Two or three *spades* or *shovels*, and a *pickaxe*, to be of good quality, and suitable for the work; *a salvagee strop*, a few pieces of *extra rope*, to be used as occasion may require.

12. A light *hand-barrow*, when thought necessary, for carrying portions of the apparatus from the cart to the place where it is to be used.

13. Three sets of *tally-boards*, each set consisting of two boards of hard wood about 9 inches long by 5 inches wide and ¾ inch thick. These boards to have the following words painted on them in white letters on a black ground, English on one side and French on the other, viz:

No. 1 tally-board to be attached to the whip.

English: Make the tail of the block fast to the lower mast, well up. If the masts are gone, then to the best place you can find. Cast off rocket line; see that the rope in the block runs free, and show signal to the shore.

French: Fouettez la poulie le plus haut possible sur le bas-mât, ou à l'endroit le plus favorable si les bas-mâts sont perdus. Detachez la ligne, voyez que la corde coure facilement dans la poulie, et faites signal au rivage.

No. 2 tally-board to be attached to the hawser.

English: Make this hawser fast about 2 feet above the tail-block. See all clear, and that the rope in the block runs free, and show signal to the shore.

French: Amarrez cette aussière à deux pieds environ au dessus de la poulie. Voyez que rien n'engage et que la corde coure facilement dans la poulie, puis faites signal au rivage.

14. *Long light.*—One box of Colonel Boxer's to be used as occasion may require.

15. *Signal rockets.*—Eighteen, throwing white and red stars.

16. *Two heaving sticks* and lines, to be used as occasion may require.

17. *A water barrico*, with a large square hinge-bung, large enough to admit a man's hand, will be supplied if specially demanded.

18. *A hawser-cutter*, for the purpose of severing a hawser from a wreck.

19. *A tarpaulin*, to cover over the apparatus and stores in the cart when the apparatus is not in use, and fitted with beckets and tent pegs to secure it on the beach or shore for coiling the whip on when the apparatus is in use.

20. *Life-belts.*—Two of Captain Ward's, and two life-lines.

N. B.—The whole of the gear, and a sufficient supply of rockets, &c., are to be kept in the rocket-apparatus cart, *in good order, dry, and ready for immediate use.*

IX. Rocket apparatus drill.[1]

1. *Always keep the gear dry and well aired.*

2. Upon the approach of a storm or thick dangerous weather on the coast, muster the gear and small stores, examine the cart, especially the axletrees, trim the lamps, and prepare for service.

3. On a wreck occurring, the watchman will call the officer and men and send for the horses.

[1] Issued by the Board of Trade [English] June, 1875.

4. Great care should be taken in arranging the apparatus with precision for firing, as after the lines become wet or dirty there is less chance of effecting a communication.

5. The rocket-line should be fastened to the rocket-stick as shown in one of the engravings. The line should have about three fathoms wetted before being rove, and should also have a figure of 8 knot made near the hole at the end of the stick, so that if the line is burnt near the rocket the knot will prevent it getting free.

6. The first rocket should always be fired with the line in the box, and the box should be slightly tilted towards the wreck.

7. In hauling off the hawser, *do not stop the end up with a rope-yarn, but leave three fathoms hanging loose.*

8. When working the whip, keep the veering part well separated from the hauling part, the parties at each standing as far apart as possible, the hawser being between the two. Lift the whip well, in order to keep clear of surf or sea-weed.

9. When the service or exercise is over, the stores are to be returned to the cart, and the party to fall into the "order of march" and return to the station.

10. *Great care should always be taken that the whole of the gear is thoroughly dried before being put away. All kinks and turns should be carefully taken out of the lines and whip.*

DRILL.

Words of command.

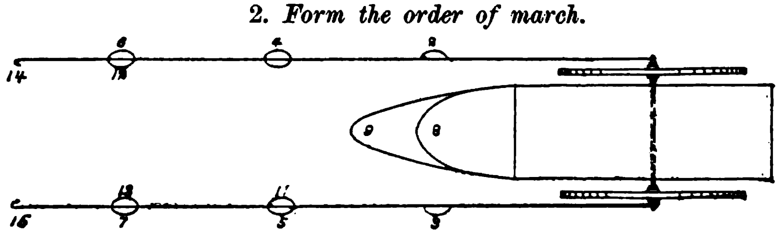
1. Rocket party, fall in.
2. Form the order of march (or double).
3. Halt.
4. Action.
5. Ready.
6. Fire.
7. Haul out.
8. Haul ashore.

1. *Rocket party, fall in.*

2, 4, 6, 8, 10, 12, 14, rear rank.
1, 3, 5, 7, 9, 11, 13, 15, front rank.

Rocket Nos. 1, 2, 3, 4, 5, 6.
Auxiliaries, 7, 8, 9, 10, 11, 12, 13, 14, 15.

2. *Form the order of march.*



Duties at the order "Halt," "Action.

No. 1 places rocket-frame; pins rocket to staff; inserts fuse; places rocket in frame; reeves line through staff; makes a figure of 8 knot near

the heel of staff; puts on two India-rubber and one metal washers, and then makes another figure of 8 knot in the end of the line-points; elevates (making due allowance for force and direction of wind); applies portfire to time-fuse, and then steps clear and removes frame when communication is effected.

No. 2 assists No. 3 to place box with line 6 yards to the rear of frame; lifts box clear of pins; fakes the stray rocket-line to the rear of frame; bends rocket-line to whip, and then takes charge of right side of whip.

No. 3, assisted by No. 2, places box with line 6 yards to the rear of frame; lifts box clear of pins and cants it in the direction of the wreck and at right angles to the line of fire; takes out water barrico and wets about 3 fathoms of end of line; then hands it to No. 1, assisting him to reeve it, and takes charge of the left side of whip.

No. 4, assisted by even numbers of auxiliaries, carries the whip 8 yards to the rear of frame, sees it clear for running, and then bends it on to hawser[1] about 2 fathoms from the end.

No. 5, assisted by odd numbers of auxiliaries, takes end of hawser and tally to 4, and clears it away for hauling off to the wrecks; clove hitches whip to traveler; bends on breeches buoy; raises triangle, and snatches hawser.

No. 6, assisted by even numbers of auxiliaries, buries anchor and backer, hooks on luff to anchor, and secures it to hawser.

No. 7 attends signals under direction of officer.

NOTE.—If there is no 7, officer attends signals.

No. 8 takes charge of life-belts, and attends to stranded crew when landed.

Odd numbers assist No. 5 to clear away hawser, keeping a slight strain on it while being hauled off to wreck; even numbers assist No. 6 to bury anchor and backer, &c., and then man the fall of the luff-tackle purchase, and veer and haul as necessary.

Even numbers assist No. 4 in working the whip, hauling off hawser, &c.

NOTE.—In working the apparatus with only six men, 3 and 5 assist No. 6 to raise triangle and attend hawser; 1, 2, and 4 attend and work the whip.

Auxiliaries.—All auxiliaries are to assist in carrying stores from cart to point of action.

Even numbers haul out hauser and breeches buoy.

Odd numbers haul ashore.

All numbers above 15 should be told off to guard the ground.

[1] Tallies are always to be kept bent on both hawser and whip, so as to be ready for service.

REPORT OF C. B. RICHARDS, ENGINEER OF COLT'S PATENT FIRE-ARMS COMPANY, UPON TESTS OF THE BEHAVIOR UNDER TENSILE STRESS OF SPECIMENS OF BRONZE RECEIVED FROM LIEUT. D. A. LYLE, ORDNANCE DEPARTMENT, UNITED STATES ARMY, WITH A DESCRIPTION OF THE TESTING-MACHINE USED.

(Plates XLII-XLV.)

The statement of the results of the tests is prefaced by descriptions of the testing-machine and apparatus used and the methods employed in the experiments.

The testing-machine is one which has been in use in the armory of this company since 1871. The basis of the machine is a platform-scale, by which the forces applied to the specimens are weighed with the same accuracy that any load may be weighed by similar scales.

Figures 1 to 4 in the accompanying drawings show different views of the machine: figure 1 being a rear elevation and figure 2 an end elevation of the entire machine; figure 3, a front elevation of the weigh-beam apparatus, and figure 4 an elevation, partly in section, of certain parts of the strain-indicating apparatus, drawn on a larger scale than the other elevations.

A is the platform of a 50-ton scale, of which B is the weigh-beam, with its sliding weight, C. Upon the platform a cast-iron frame, D, is placed, to sustain the nut of a screw, E, to whose lower end are applied the fixtures for holding the upper end of a specimen intended to receive a tensile strain. The platform is 5 feet long by 3 feet wide, and has an oblong opening in its center, through which two long screws rise about 2 feet above the platform. The screws carry a strong cross-head, F, which can be raised or lowered by two nuts, G. The screws and cross-head are not connected with the platform until the specimen makes the connection. The cross-head receives the fixtures for applying strains of all kinds to specimens of every shape. For tensile strains the holders which grasp the lower end of the specimen are attached to the top of the cross-head. The lower ends of the screws G are attached to the short arms of a massive forked lever, H, which is beneath the floor, and has its fulcra supported by the bed-plate which forms the foundation of the scale. The long arm of this lever is coupled to the fulcrum *i* of a short lever, I, which is so suspended from a longer lever, J, that the two levers form a differential system, the fulcra *j* and *i* of the two levers not being in the same vertical plane. The fulcrum *j* of lever J is raised or lowered by a screw, K, whose nut is supported by a cast-iron frame, L, erected upon the scale-foundation. This nut is worked by the hand-wheel M through a system of toothed wheels, or when the back gearing (shown at N, Fig. 2) is thrown into engagement by turning the lever N′, the nut may be worked through the pulley O by power obtained from the factory shafting. The connections between the lever J and the screws G, which carry the cross-head, are so arranged that, by depressing the longer free arm of J the cross-head is pulled downward, and by raising the fulcrum of J the same result is produced. A rod, P, is suspended from the end of the longer arm of the lever J, to which plates and pans are attached to receive weights of various values, and counter-weights Q may be applied to the shorter arm of the lever to balance wholly or partly the preponderance of the longer arm. The lower end of the rod P is provided with a piston, which moves in a large cylindrical vessel containing oil and serving to prevent a too rapid fall

of the loaded end of the lever. If the foregoing description is understood, it is evident that if one end of a specimen, a rod of iron, for instance, be attached to the frame D above the cross-head F and the other end be attached to the cross-head, the specimen may be stretched by bearing down the end of the straining-lever J, for the cross-head will thereby be pulled downward. The arms of the levers are so proportioned that one pound applied at P will exert a strain of 120 pounds on the specimen; so a strain of 100,000 pounds will be exerted by the application of 800 pounds at P. The specimen can also be strained by weighting the rod P so heavily that it will be held down, and then by working the nut of the screw K, either by hand or power, the fulcrum *j* will be raised, and the cross-head pulled downward with a force increasing as gradually as may be desired. As the specimen is suspended from the frame on the platform of the scale, any stress with which it is pulled will be indicated at the weight-beam B and can thus be accurately weighed. The strain-indicating apparatus is shown in Figs. 3 and 4. B is the weigh-beam of the scale with its sliding weights C. The beam is graduated to thousand-pound intervals, and the small weight will show 20-pound increments. A long straight rod, *a*, hangs at the end of the weigh-beam and dips into a cylindrical vessel, *b*, which is movable up and down and is filled with mercury. The weight of the rod *a* is so adjusted that when the rod hangs wholly in air it will exactly balance 10,000 pounds on the platform of the scale, but when immersed to a certain point in mercury it floats and ceases to act as a weight; between these two points its value as a weight depends on the extent of its immersion in the mercury, which is regulated by the height at which the vessel *b* stands. The mercury vessel may be raised by turning a pinion which works in a rack fastened along the side of the vessel, and the vessel may be held up by a pawl, *c*, which tends to engage with the teeth of a ratchet-wheel, *d*, fastened to the pinion-shaft. When the pawl is disengaged and its from the wheel, the vessel descends by its own weight, but its speed of falling is controlled by a piston sliding in a cylinder, *e*, filled with oil, the top of the piston-rod *f* being connected with the vessel by a chain passing over the sheaves *g*. A pipe, *h*, connects the upper part of the oil cylinder with the lower part, and a screw-valve, *k*, in the pipe regulates the flow of oil, which is produced by the piston rising through the cylinder. The variation which opening or closing the screw-valve *k* occasions in the resistance to the flow of oil through the pipe affords the means of regulating the rapidity of descent of the vessel *b*. A valve in the piston permits the mercury vessel to be raised quickly, even when the screw-valve *k* is closed. A scale, *l*, on the side of the mercury vessel indicates the extent to which the rod *a* is immersed in the mercury, and the scale is so marked that the valve of the rod in balancing a load on the platform may be read for any position of the vessel to within 20 pounds, which is as small difference as the testing-machine is intended to indicate. The range of the scale is 10,000 pounds. The values of the scale readings can be checked at any time by the weights C on the beam, and have been found to be invariably correct. When greater loads than 10,000 pounds are to be observed, the surplus is balanced at the beam by the weights C. When used to weigh gradually-increasing strains, the operation of this apparatus is made automatic in the following manner:

On the end of the weigh-beam B is fastened a small cup, *m*, containing mercury, into which platinum wire, *n*, constantly dips. The point of a second platinum wire, *p*, stands a little above the surface of the mercury when the beam B is down, but when the beam rises this wire also dips into the mercury. The platinum wires form the terminals of two

insulated wires leading from the two poles of a galvanic battery whose circuit is closed when the rising of the beam immerses the two platinum points in the mercury, but is open when the beam is down. An electromagnet, *r*, is inserted in the course of one of the wires and the armature of this magnet is so connected with the pawl which sustains the mercury vessel that when the battery circuit is closed and the magnet is thus vitalized, the pawl *c* is drawn away from the wheel *d*, but when the circuit is broken the pawl falls back again and locks the wheel.

When sufficient stress to overcome the weight C is applied to a specimen the weigh-beam rises and closes the electric circuit by which the pawl is made to unlock the wheel *d*; the mercury vessel then descends until enough of the rod *a* is uncovered by the mercury to enable the rod to balance the stress and draw the beam downward. The electric circuit is thus broken, and the pawl locks the wheel, preventing a further descent of the mercury vessel and leaving the beam poised until it is raised by a further increase of stress.

This automatic action may be continued until the specimen breaks, when the beam of course drops and the mercury vessel *b* is locked in place by the pawl. The sum of the readings of the weight C on the beam, and the scale *l* on the mercury vessel, gives the maximum stress on the specimen.

Figures 5, 6, and 7 show one of the pair of clasps for fastening the specimens in the machine. Figure 13 represents the finished specimen, and figure 12 shows the specimen with nuts screwed on its ends to form heads by which the specimen may be grasped by the clasp. The clasp is made in halves hinged together, and is shown open in figures 5 and 6 and closed in figures 7 and 8. One clasp embraces the upper head of the specimen and the lower end of the screw E of the testing-machine, thus attaching the specimen to the screw. The other clasp embraces the lower head of the specimen and the upper end of a bolt fastened in the top of the pulling cross-head F, attaching the specimen to the cross-head and thus forming the connection between the cross-head and the platform. The halves of the clasp, when they are put in place in the machine, are locked together by pins passing through the axes of the hinges, as shown. A specimen is represented in place in the machine at *s*, figure 2. Two different gauges were used to measure the extensions of the specimens; one of these, shown in figures 11 and 12, was used for stresses within the elastic limit, and the other, illustrated in figure 9, was applied after the elastic limit was passed.

The first (A) consists of two plates of glass held face to face in separate steel frames, which are locked together and slide freely along each other; one of the frames is terminated by a ball, and the other by a stem at the end of which is a similar ball. By grasping the balls and pulling them apart the glass plates slide along each other. On the longer glass plate a scale is ruled with fine lines, 1 inch being there divided into 100 parts. On the shorter plate a space $\frac{1}{100}$ of an inch long is divided into ten parts, the lines being $\frac{1}{1000}$ of an inch apart. The ball-shaped ends of this sliding gauge are clamped in the jaws of two holders, shown in figures 10 and 12, one of which is clamped around each end of the cylindrical part of the specimen. When the gauge is thus fastened in place and the specimen is stretched, the scales pass over each other lengthwise, and by observing the scales through a powerful microscope the extensions may be read to within a ten-thousandth of an inch, for it is easy to subdivide to tenths by the eye the spaces between the lines of the small scale.

A microscope, not shown in the drawings, is so fastened on the machine that the gauge-readings can easily be observed.

The gauge B is a sliding vernier gauge, reading to thousandths of an inch. Its two ends are fastened to the two specimen clasps, which, as they become separated by the stretching of the specimen, draw the vernier of the gauge over the scale, and the extensions may be obtained from the changes in the gauge-readings.

Method of testing.

The specimens were tested in lots of 4 as they were received. Each one was first tested up to and somewhat beyond the elastic limit, the stress being applied by working the straining-screw nut by hand. The gauge A was applied to the specimen, and the extensions corresponding to different stresses were read from this by using the microscope. A reading was taken at 1,000 pounds, after which the stress was increased to 2,000 pounds, and a second reading recorded. The stress was then reduced to 1,000 pounds and the corresponding reading again taken. The extension of 3,000 pounds was then observed, and afterward at 1,000 pounds, and so on with increased stresses and repeated reductions of the stress to 1,000 pounds until the probable elastic limit was approached, when the increments of stress between the observations of extension were reduced to 500 pounds. As soon as a permanent set occurred, which indicated that the elastic limit had been exceeded, this was shown by a difference between the last reading at 1,000 pounds stress and former readings for that stress. The greatest stress observed before this set occurred has been taken for the elastic limit of the specimen. After the elastic limit had been exceeded by several thousands of pounds and the corresponding extensions observed for all the specimens, the first specimen was again placed in the machine and the gauge applied to the holders. A gradually increasing pull, starting from the greatest stress before observed, was then produced by working the straining-screw nut at a uniform speed by the pulley *o*, driven by the factory shafting, while the progress of the increasing stress was observed by watching the descent of the mercury vessel *b*, and at the instant the scale on the vessel indicated each increase of 1,000 pounds stress the reading of the gauge which indicated the corresponding extension was taken until the fracture of the specimen occurred. The extensions of the specimen by strain corresponding to the different pulling stresses were then plotted graphically, and the curves thus formed are shown in figures 14, 15, and 16. Figure 17 is a photograph showing the original shape and surface of the specimen compared with its appearance after having been broken. The broken specimen here represented is No. 914, marked H 3, from gun A.

The data and results of the tests are given in the accompanying table.

Report of the results of tests by the Colt's Patent Fire-Arms Manufacturing Company of the behavior under pulling stress of twelve specimens of bronze received from Lieut. D. A. Lyle.

[Dimensions and areas are given in inches, stresses in pounds, and resistances in pounds per square inch of the original cross-section of the specimen.]

Test number of the specimen	912	913	914	915	937	938	939	940	982	983	984	985
Original mark	A. H. 1.	A. H. 2.	A. H. 3.	A. H. 4.	B. H. 1.	B. H. 2.	B. H. 3.	B. H. 4.	C. H. 1.	C. H. 2.	C. H. 3.	C. H. 4.
Diameter of minimum cross-section. Original	0.789	0.797	0.797	0.798	0.798	0.798	0.798	0.798	0.798	0.798	0.798	0.798
Diameter of minimum cross-section. After fracture	0.6	0.61	0.6	0.73	0.66	0.67	0.665	0.73	0.74	0.75	0.73	0.75
Area of minimum cross-section. Original	0.498	0.499	0.499	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Area of minimum cross-section. After fracture	0.28	0.29	0.28	0.42	0.34	0.35	0.35	0.42	0.43	0.44	0.42	0.44
Distance between gauge marks. Original	3.49	3.49	3.49	3.49	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Distance between gauge marks. At instant of fracture	5.38	5.30	5.38	3.95	4.69	5.02	4.95	4.07	4.1	3.96	4.1	3.7
Distance between the shoulders. Original	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Distance between the shoulders. At instant of fracture	6.58	6.58	6.65	5.04	5.86	6.31	6.21	5.21	5.19	5.11	5.14	4.74
Extensions produced by increasing the stress from 1,000 pounds to 3,000 pounds	0.0011	0.0010	0.00085	0.0010	0.0011	0.0011	0.0011	0.0014	0.0014	0.0014	0.0014	0.0017
Greatest observed stress sustained without set	5,500	6,000	6,000	3,500	6,000	5,500	6,500	4,500	5,000	4,500	4,500	3,000
Breaking stress	23,280	23,340	23,740	14,220	20,820	21,900	21,920	16,860	13,980	13,200	13,980	9,580
Moduli of elasticity, in pounds per square inch	12,700,000	14,000,000	16,500,000	14,000,000	12,700,000	12,700,000	12,700,000	10,000,000	10,000,000	10,000,000	10,000,000	8,200,000
Limit of elastic resistance	11,600	12,000	12,000	7,000	12,000	11,000	13,000	9,000	10,000	9,000	9,000	6,000
Ultimate resistance (tenacity)	47,600	46,780	47,580	28,440	41,640	43,800	43,840	33,720	27,960	26,400	27,960	19,160
Greatest reduction of cross-section, per cent	42.1	41.5	43.3	16.4	31.6	29.6	30.6	16.4	14.0	12.	16.	12.
Ultimate elongation between gauge marks, per cent	54.1	51.6	53.9	13.3	34.0	43.4	41.4	16.3	17.1	13.1	17.1	5.7
Work performed in breaking the specimens, per cubic inch of material between the shoulders	1,500	1,700	1,500	*230	820	1,180	1,120	*370	280	230	270	*70

*Foot-pounds.

Temperature of the testing-room 73° F.

C. B. RICHARDS, *Engineer.*

OFFICE OF THE COLT'S PATENT FIRE-ARMS MANUFACTURING COMPANY,
Hartford, June 26, 1878.

INDEX.

I.—REPORT OF GENERAL SUPERINTENDENT.

TABLES ACCOMPANYING REPORT.

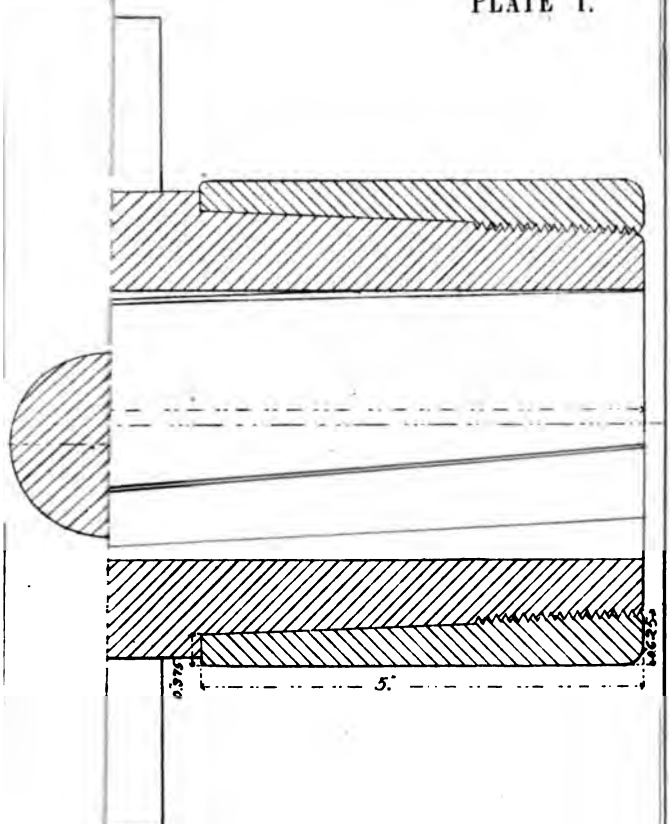
GREAT LAKES.

RIVERS.

AT SEA OR IN FOREIGN WATERS.

II.—REPORT OF LIEUT. D. A. LYLE.

PLATE I.



E-SAVING APPARATUS.

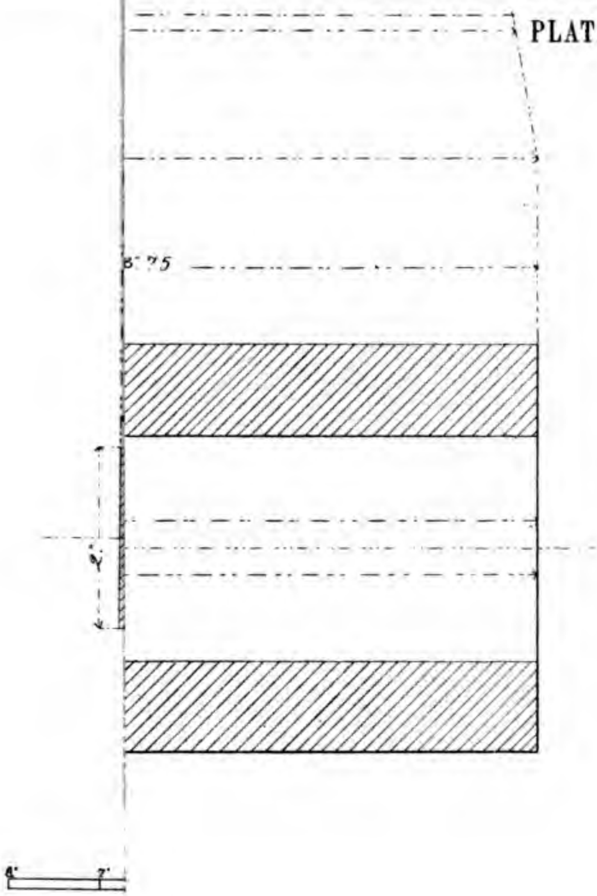
THREE-INCH

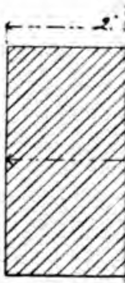
-LOADING RIFLED MORTAR.

verted from an old Bronze Gun.

Accompanying Appendix P, 1878

PLATE II.





IFE-SAVING APPARATUS.

RIMENTAL BRONZE GUN, "A,"

2½ Inch, Smooth Bore.

DESIGNED BY

. D. A. LYLE, Ordnance Department, U. S. Army.

JULY 26, 1877.

Accompanying Appendix P, 1878

PLATE III.

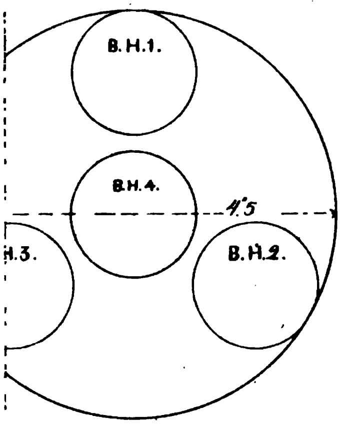
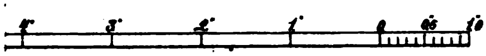


Fig. 4.



SAVING APPARATUS.

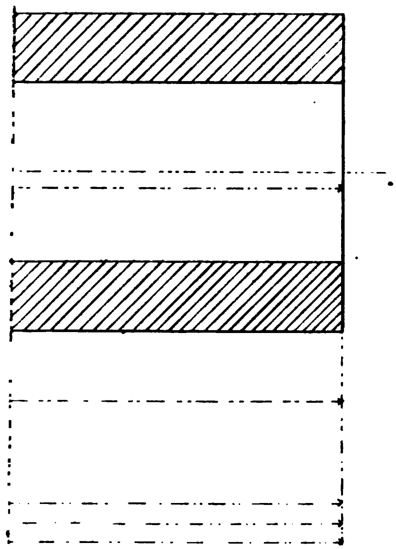
IENS OF BRONZE

FOR TESTING,

ns of Sinking Heads, showing the relative
positions of Specimens tested.

Accompanying Appendix P, 1878

PLATE. IV.



E-SAVING APPARATUS.

MENTAL BRONZE GUN, "B,"

Two Inch, Smooth Bore.

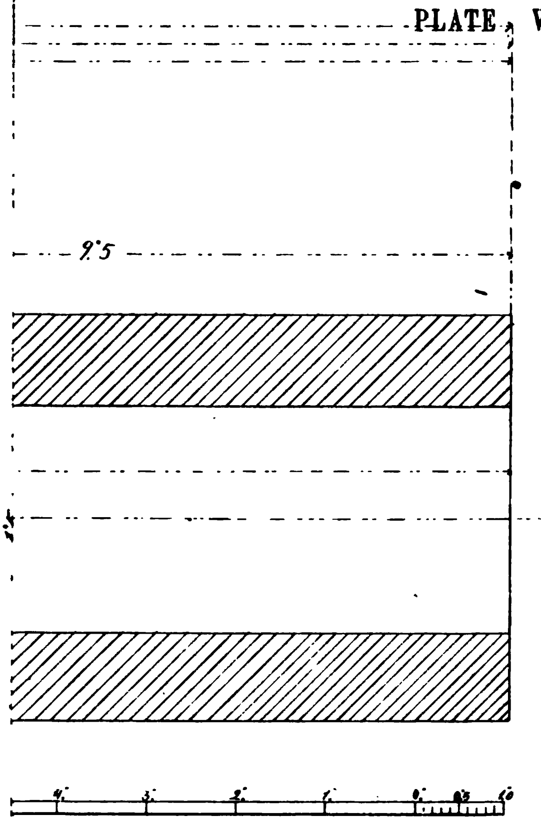
DESIGNED BY

A. LYLE, Ordnance Department, U. S. Army.

AUGUST 7, 1877.

Accompanying Appendix P, 1878

PLATE V.



IFE-SAVING APPARATUS.

RIMENTAL BRONZE GUN, "C,"

2½ Inch, Smooth Bore.

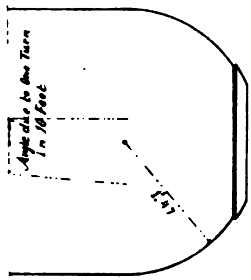
DESIGNED BY

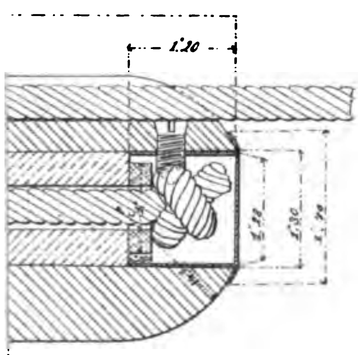
t. D. A. LYLE, *Ordnance Department, U. S. Army.*

AUGUST 14, 1877.

Accompanying Appendix P, 1878

PLATE VI.





E.SAVING APPARATUS.

MENTAL PROJECTILE, No. 1,

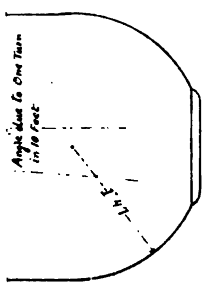
Three Inch, Rifle.

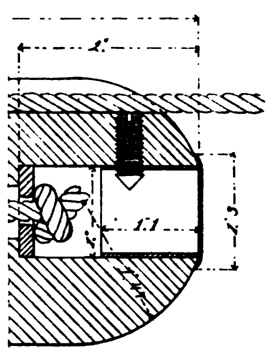
1877.

MARKS: C 1 and C 2.

Accompanying Appendix P, 1878

PLATE VII.





LIFE-SAVING APPARATUS.

ERIMENTAL PROJECTILE, No. 2,

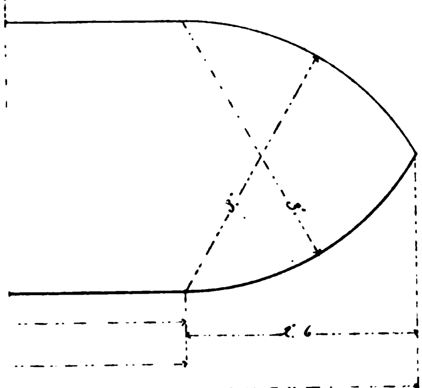
Three Inch, Rifle.

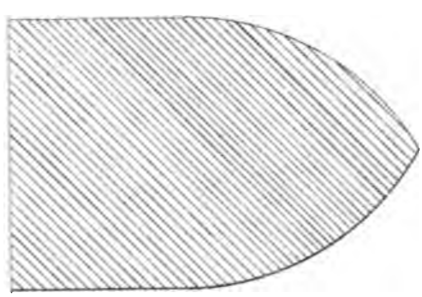
1877.

MARKS: CL 3 and CL 4.

Accompanying Appendix P, 1878

PLATE VIII.





FE-SAVING APPARATUS.

IMENTAL PROJECTILE, No. 3,

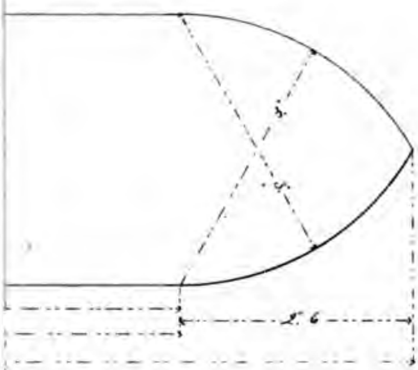
Three Inch, Smooth Bore.

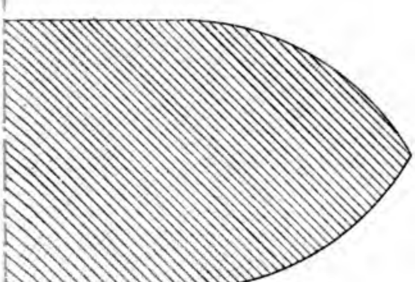
1877.

MARKS: C 5 and C 6.

Accompanying Appendix P, 1878

PLATE IX.





SAVING APPARATUS.

ENTAL PROJECTILE, No. 4,

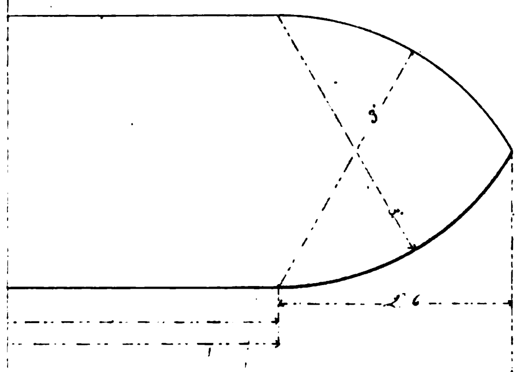
ree Inch, Smooth Bore.

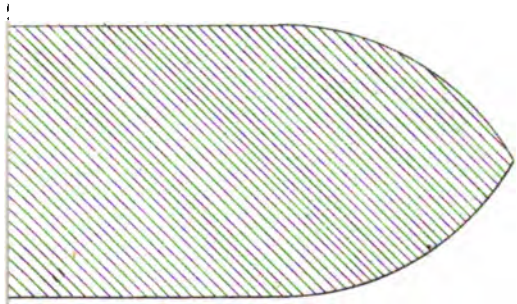
1877.

MARKS: C 7.

Accompanying Appendix P, 1878

PLATE X.





LIFE-SAVING APPARATUS.

PERIMENTAL PROJECTILE, No. 5,

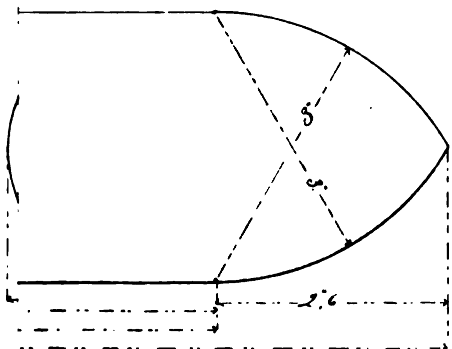
Three Inch, Smooth Bore.

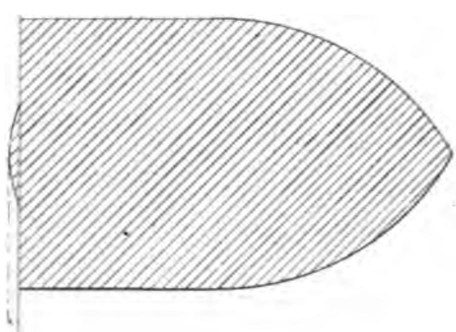
1877.

MARKS: C 8 and C 9.

Accompanying Appendix P, 1878

PLATE XI.





:FE-SAVING APPARATUS.

[MENTAL PROJECTILE. No. 17,

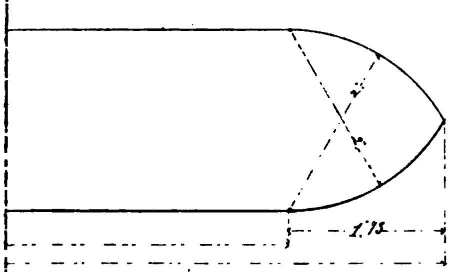
Three Inch, Smooth Bore.

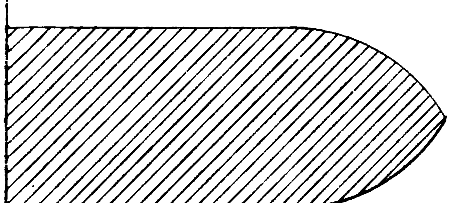
1878.

[ARKS: From "C 10" to "C 14," both inclusive.

Accompanying Appendix P. 1878

PLATE XII.





FE-SAVING APPARATUS.

IMENTAL PROJECTILE, No. 6,

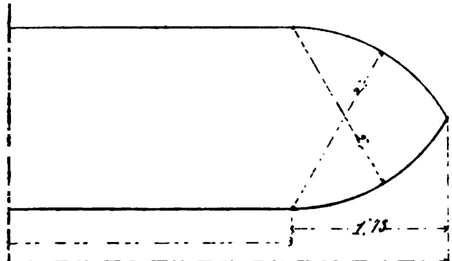
Two Inch, Smooth Bore.

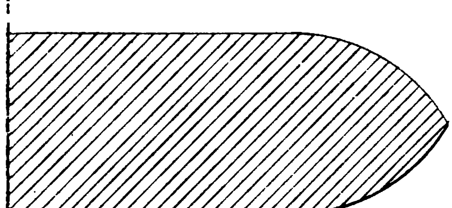
1877.

MARKS: LL 1.

Accompanying Appendix P, 1878

PLATE XII.





E-SAVING APPARATUS.

IMENTAL PROJECTILE, No. 6,

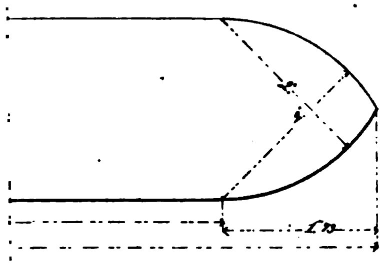
Two Inch, Smooth Bore.

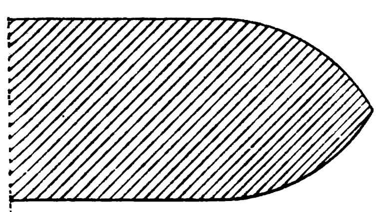
1877.

MARKS: LL 1.

Accompanying Appendix P, 1878

PLATE XIII.





E-SAVING APPARATUS.

MENTAL PROJECTILE, No. 7.

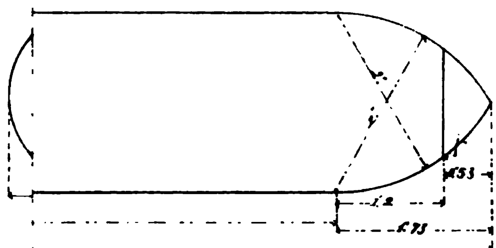
Two Inch, Smooth Bore.

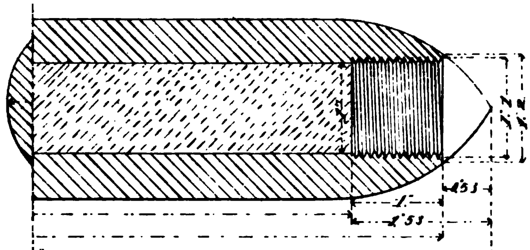
1877.

ARKS: LL 2 and LL 3.

Accompanying Appendix P, 1878

PLATE XIV.





FE-SAVING APPARATUS.

RIMENTAL PROJECTILE, No. 8,

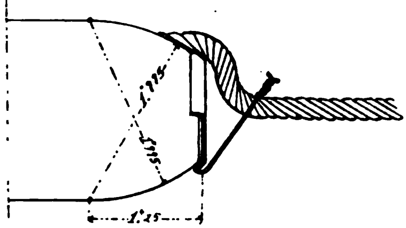
Two Inch, Smooth Bore.

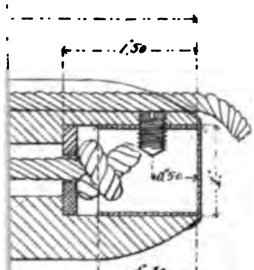
1877.

MARKS: LL 4 and LL 5.

Accompanying Appendix P, 1878

PLATE XV.





-SAVING APPARATUS.

ENTAL ·PROJECTILE, No. 9,

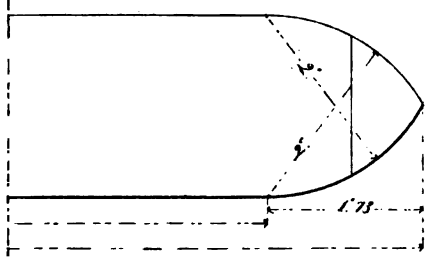
'wo Inch. Smooth Bore.

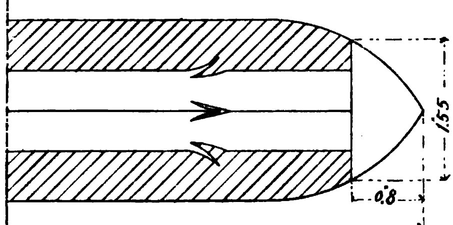
1877.

RKS: LL 6 and LL 7.

Accompanying Appendix P, 1878

PLATE XVI





IFE-SAVING APPARATUS.

IMENTAL PROJECTILE, No. 13.

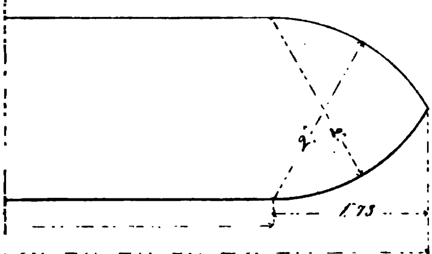
Two Inch, Smooth Bore.

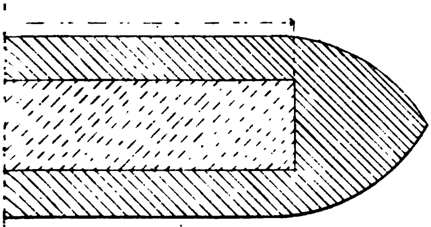
1878.

MARKS: "LL O."

Accompanying Appendix P, 1878

PLATE XVII.





FE-SAVING APPARATUS.

MENTAL PROJECTILE, No. 14,

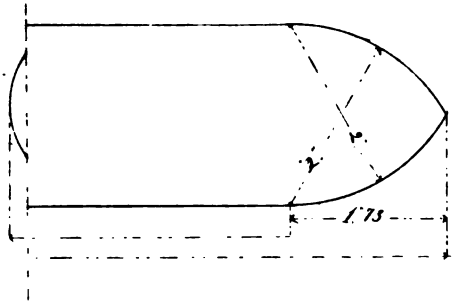
Two Inch, Smooth Bore.

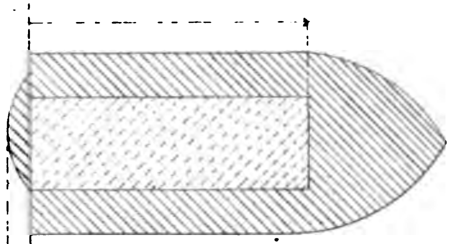
1878.

MARKS: "LL 8."

Accompanying Appendix P, 1878

PLATE XVIII.





E-SAVING APPARATUS.

IENTAL PROJECTILE, No. 15.

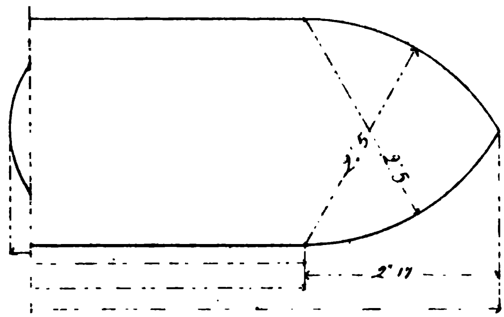
Two Inch, Smooth Bore.

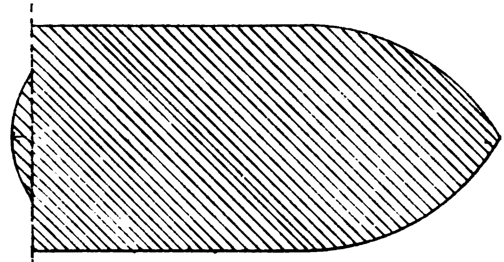
1878.

KS: From "L L 9" to "L L 14," both inclusive.

Accompanying Appendix P, 1878

PLATE XIX.





IFE-SAVING APPARATUS.

RIMENTAL PROJECTILE, No. 10,

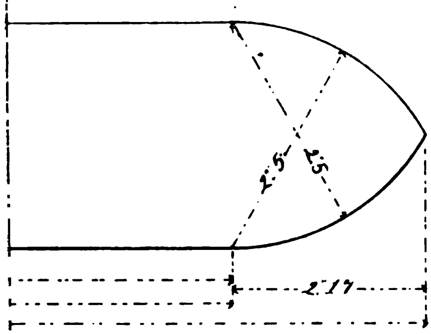
2½ Inch, Smooth Bore.

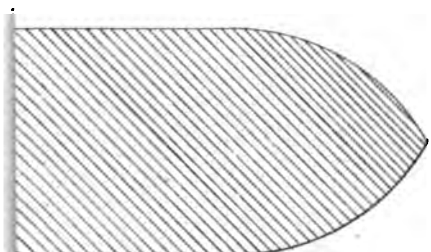
1877.

MARKS: L 1 and L 2.

Accompanying Appendix P, 1878

PLATE XX.





-SAVING APPARATUS.

ENTAL PROJECTILE, No. 11,

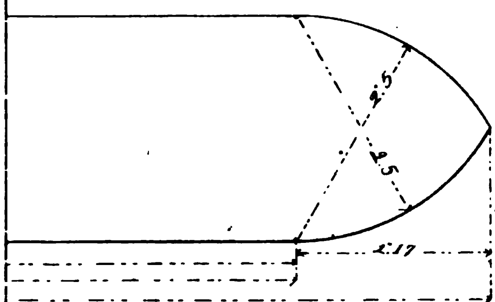
2½ Inch, Smooth Bore.

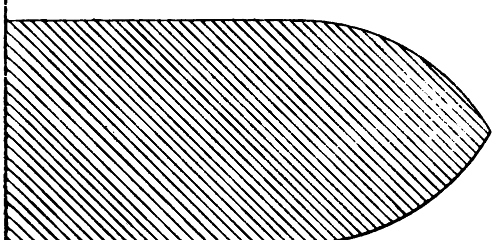
1877.

MARKS; L 3.

Accompanying Appendix P, 1878

PLATE XXI.





LIFE-SAVING APPARATUS.

RIMENTAL PROJECTILE, No. 12,

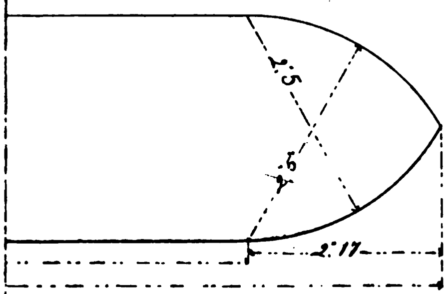
2½ Inch, Smooth Bore.

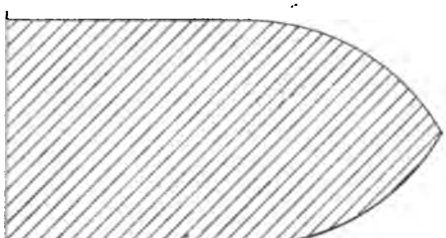
1877.

MARKS: L 4.

Accompanying Appendix P, 1878

PLATE XXII.





FE-SAVING APPARATUS.

IMENTAL PROJECTILE, No. 16,

2½ Inch, Smooth Bore.

1878.

MARKS: From "L 5" to "L 13," both inclusive.

Accompanying Appendix P, 1878

PLATE XXIII.

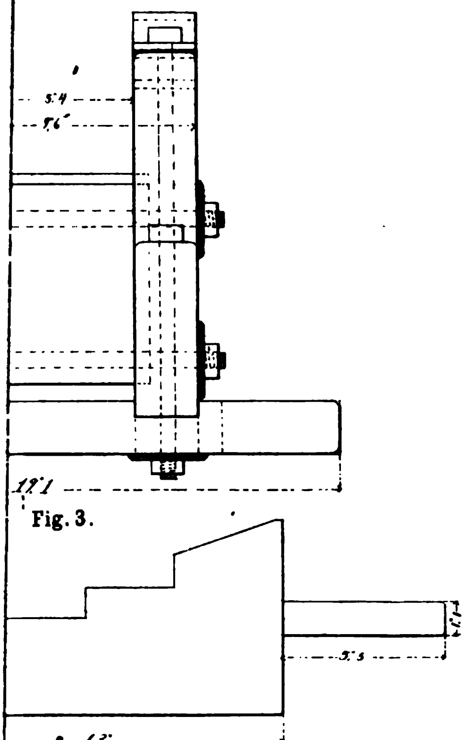


Fig. 3.

E-SAVING APPARATUS.

CARRIAGE No. 1,

FOR

NCH M. L. RIFLED MORTAR.

Accompanying Appendix P, 1878

PLATE XXIII.

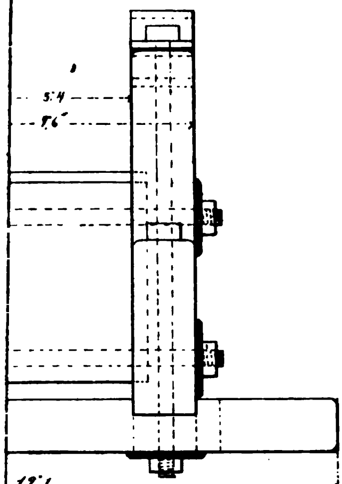
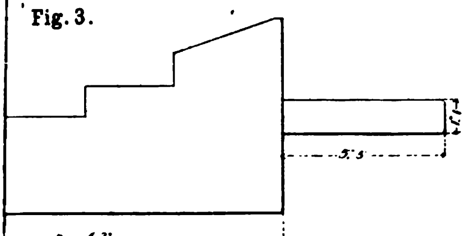


Fig. 3.



E-SAVING APPARATUS.

ARRIAGE No. 1,

FOR

NCH M. L. RIFLED MORTAR.

Accompanying Appendix P, 1878

PLATE XXIV.

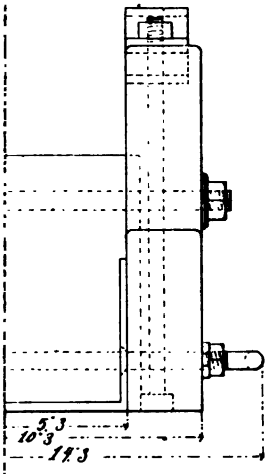
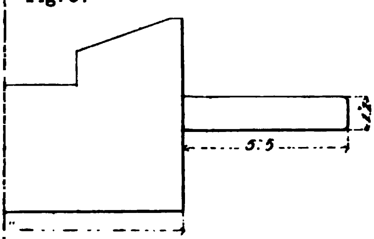


Fig. 3.



FE-SAVING APPARATUS.

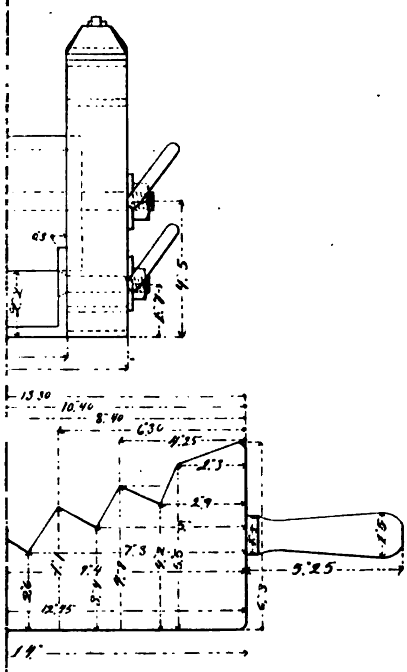
CARRIAGE No. 2,

FOR

INCH M. L. RIFLED MORTAR.

Accompanying Appendix P, 1878

PLATE XXV.



SAVING APPARATUS.

CARRIAGE

FOR

ENTAL BRONZE GUN, "A."

Accompanying Appendix P, 1878

PLATE XXVI.

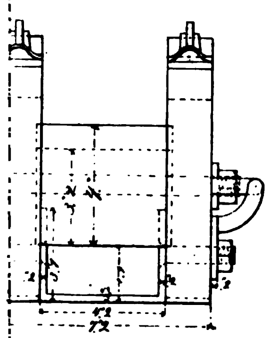
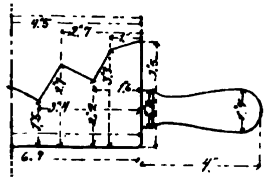


Fig. 3.



LIFE-SAVING APPARATUS.

CARRIAGE

FOR

RIMENTAL BRONZE GUN, "B."

Accompanying Appendix P, 1878

PLATE XXVII.

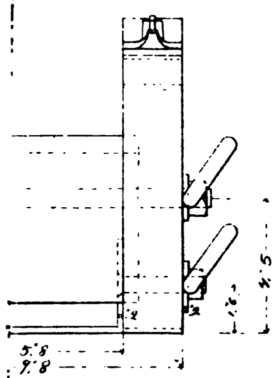
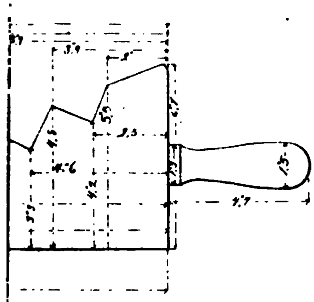


Fig. 3.



IFE-SAVING APPARATUS.

CARRIAGE

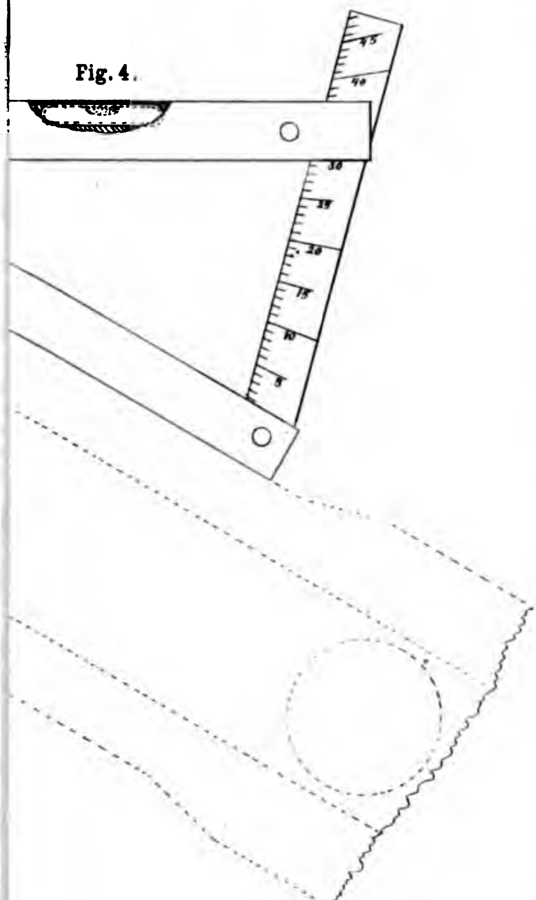
FOR

IMENTAL BRONZE GUN, "C."

Accompanying Appendix P, 1878

PLATE XXVIII.

Fig. 4.



FE-SAVING APPARATUS.

IDGE BAGS, PRIMING WIRE,

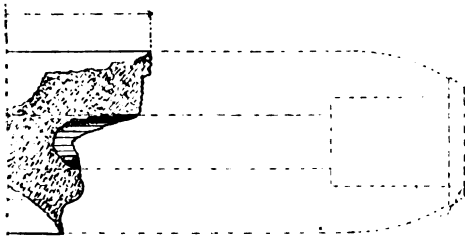
AND

FOLDING OCTANT,

obtaining Angles of Elevation.

Accompanying Appendix P, 1878

PLATE XXIX.



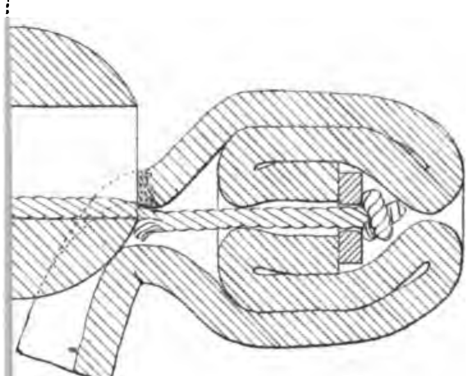


Fig. 13.

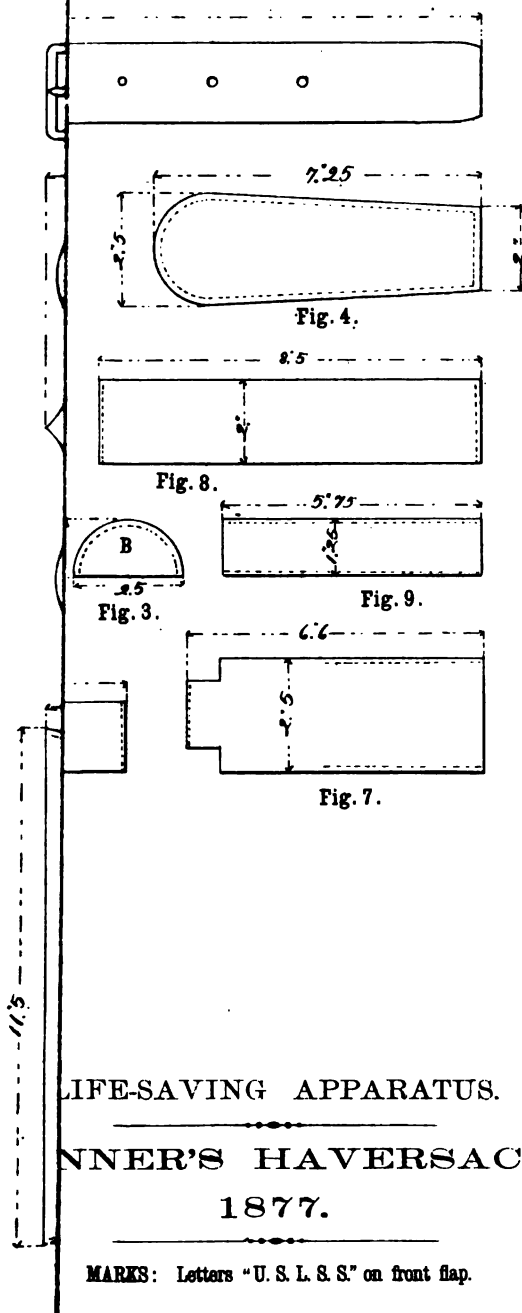
'E-SAVING APPARATUS.

TS AND DRAWINGS,

ng Effect of Gas penetrating the axial cavity
of Experimental Projectiles.

Accompanying Appendix P, 1878

PLATE XXX.



LIFE-SAVING APPARATUS.

NNER'S HAVERSACK.

1877.

MARKS: Letters "U. S. L. S. S." on front flap.

Accompanying Appendix P, 1878

PLATE XXXI.

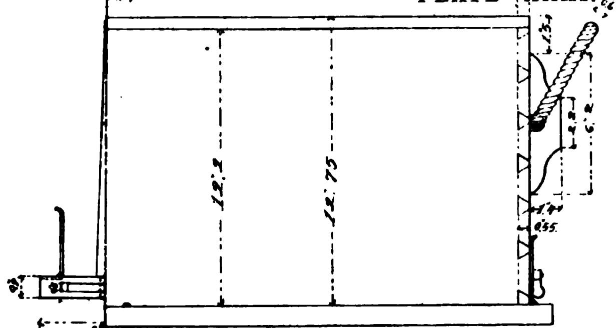
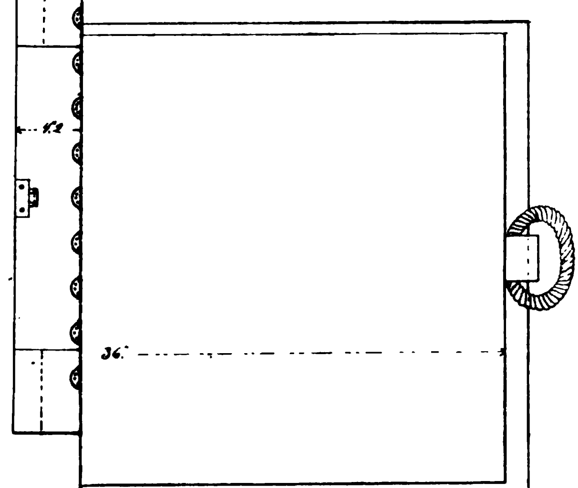
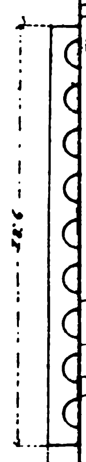


Fig. 2.



g. 1.



-SAVING APPARATUS.

FAKING BOX, "A,"

Regulation Size.

Accompanying Appendix P, 1878

PLATE XXXI.

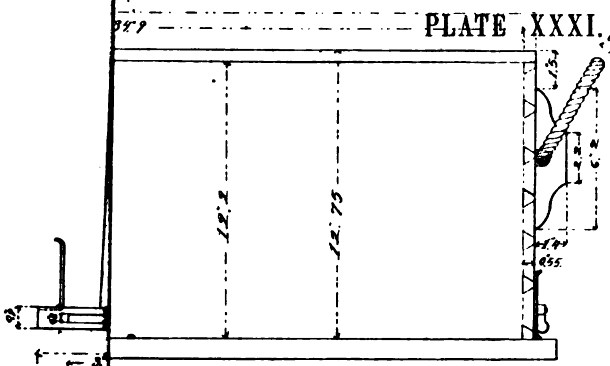
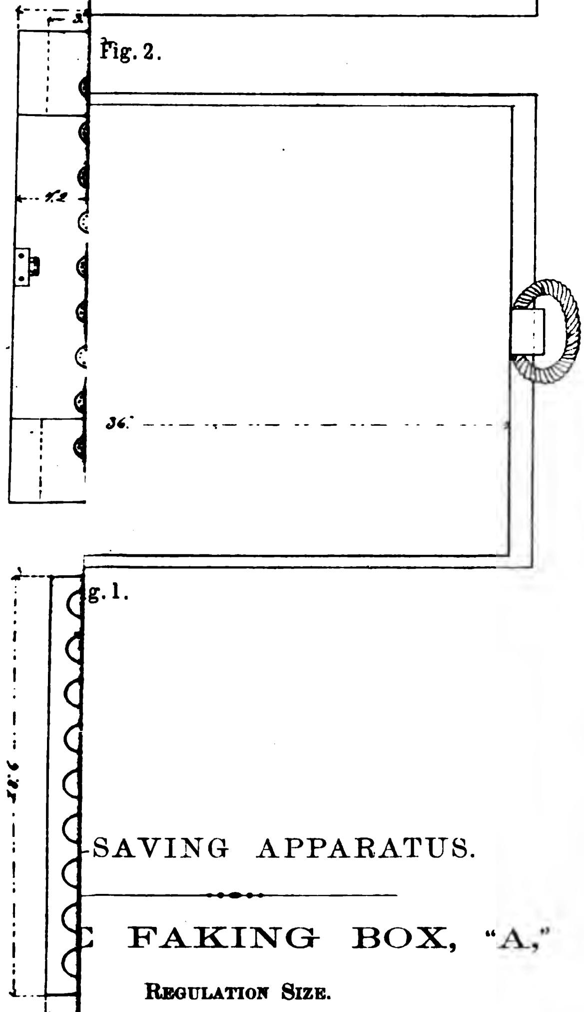


Fig. 2.



g. 1.

-SAVING APPARATUS.

C FAKING BOX, "A,"

Regulation Size.

Accompanying Appendix P, 1878

PLATE XXXII

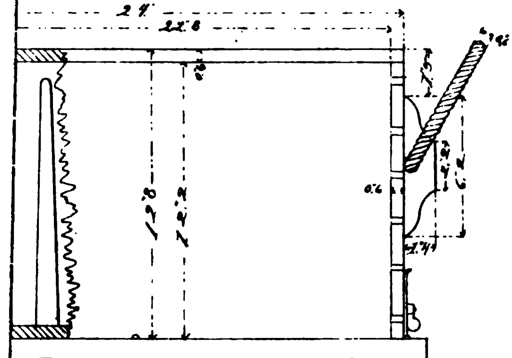


Fig. 2.

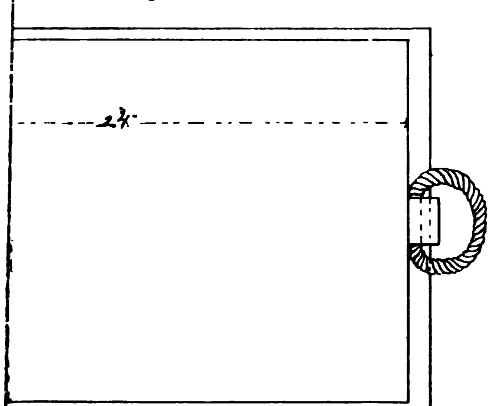


Fig. 1.

E-SAVING APPARATUS.

L FAKING BOX, "B,"

Regulation Size.

Accompanying Appendix P, 1878

PLATE XXXIII.

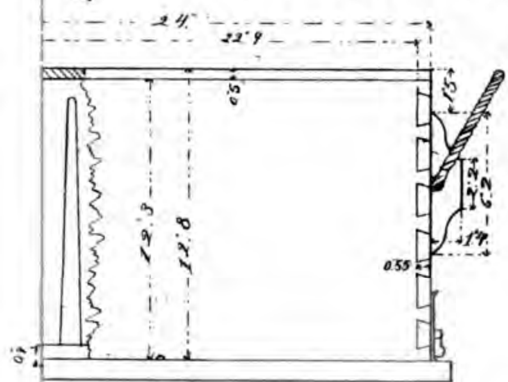


Fig. 2.

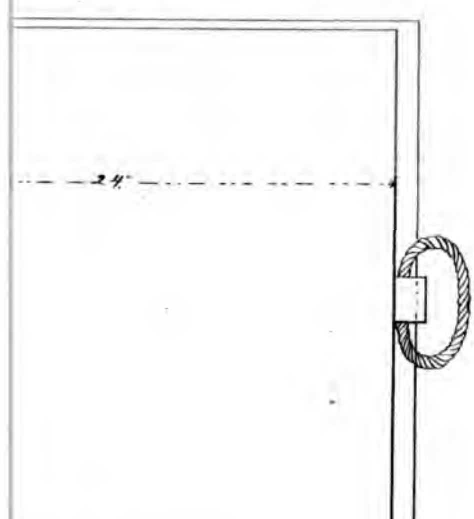


Fig. 1.

SAVING APPARATUS.

ENTAL FAKING BOX, "C,"

LARGE, SQUARE.

Acc

PLATE XXXIV.

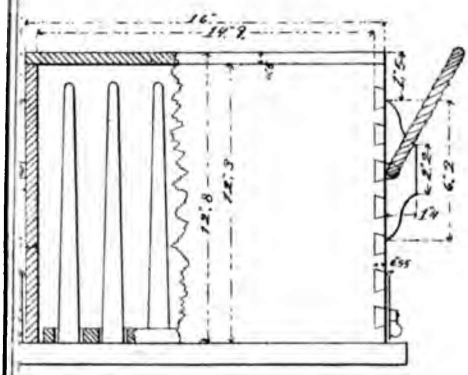


Fig. 2.

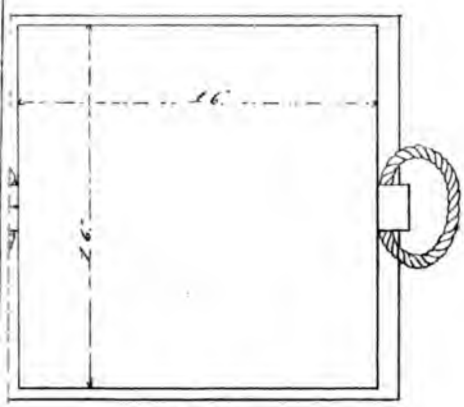


Fig. 1.

-SAVING APPARATUS.

MENTAL FAKING BOX, "D,"

SMALL, SQUARE.

Accompanying Appendix P, 1878

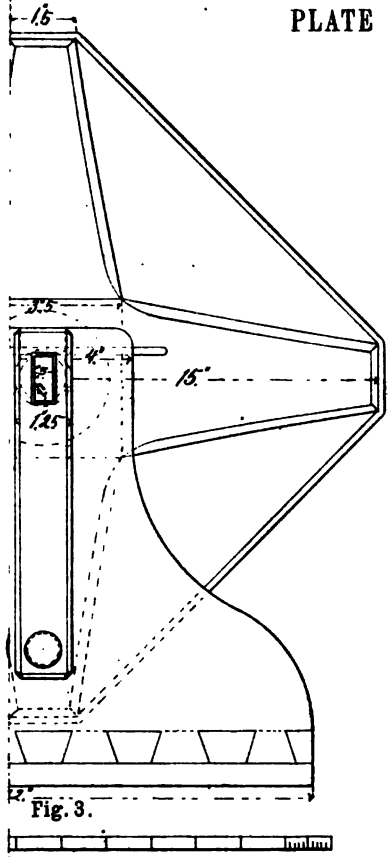


Fig. 3.

SAVING APPARATUS.

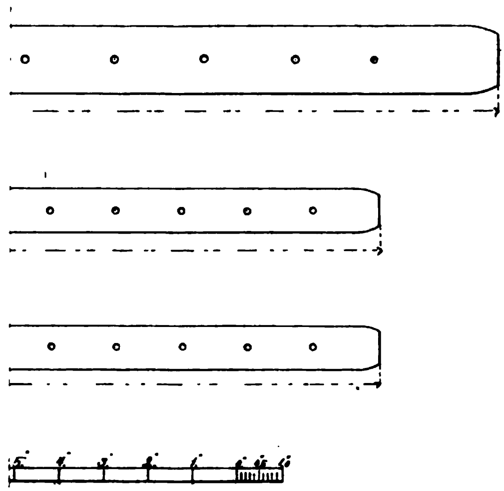
AND FRAME,

FOR

king up Shot Line.

1877.

PLATE XXXVI.



LIFE-SAVING APPARATUS.

CARRYING BRACES,

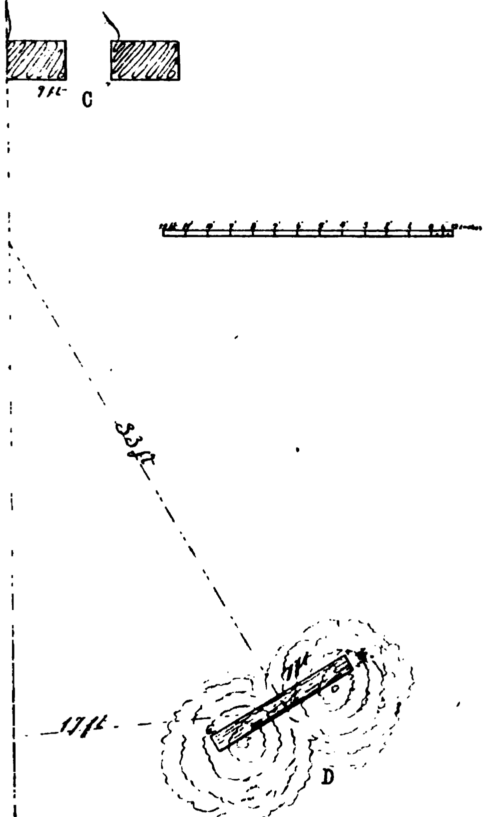
FOR

SHOT LINE REEL.

1877.

Accompanying Appendix P, 1878

PLATE XXXVII.



E-SAVING APPARATUS.

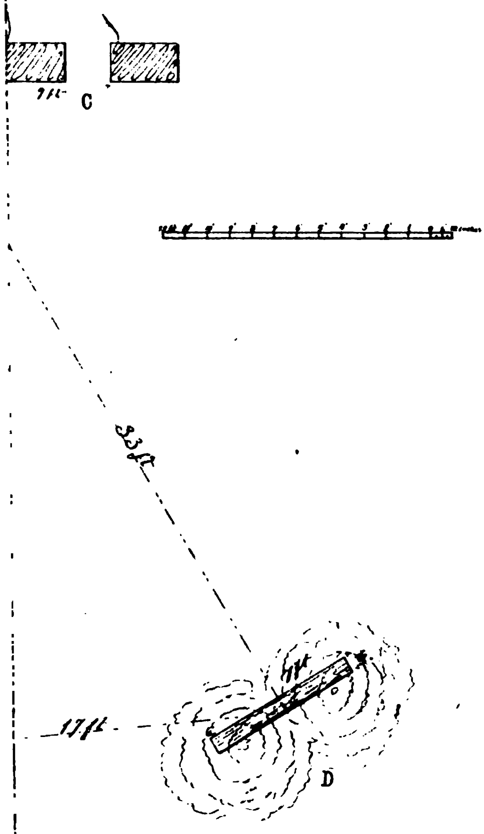
MENTAL FIRING GROUND,

SPRINGFIELD, MASS.

1877.

Accompanying Appendix P, 1878

PLATE XXXVII.



E-SAVING APPARATUS.

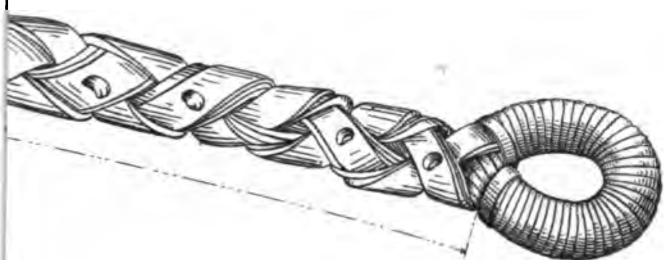
MENTAL FIRING GROUND,

SPRINGFIELD, MASS.

1877.

Accompanying Appendix P, 1878

PLATE XXXVIII.



AVING APPARATUS.

NBY'S SHOT.

Accompanying Appendix P, 1878

PLATE XXXIX.

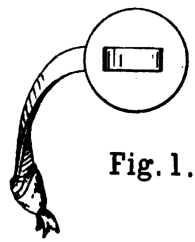
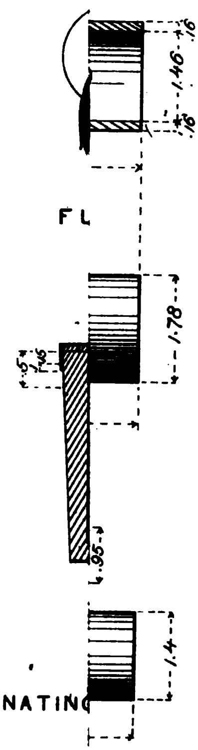


Fig. 1.



F L

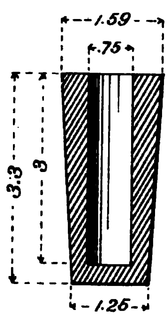
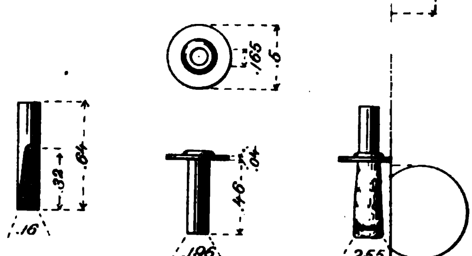


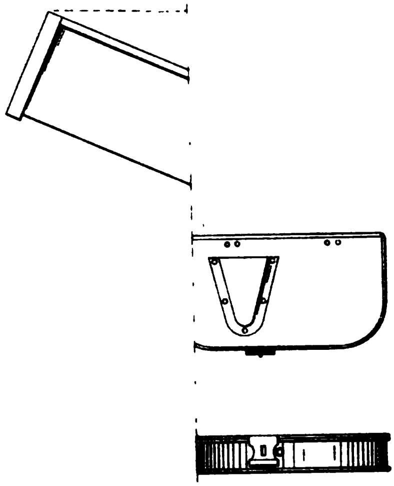
Fig. 4.

DETONATIN

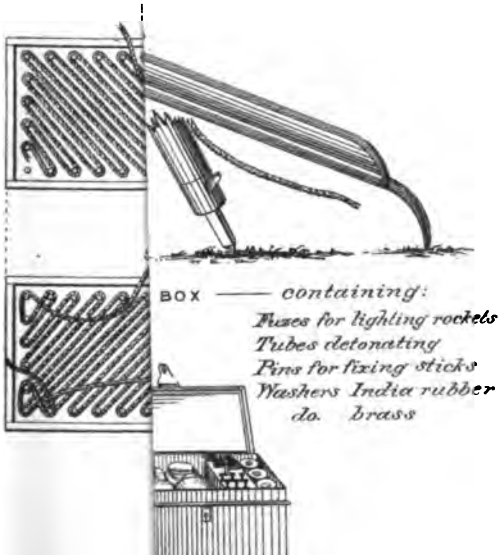


, 1878

PLATE XL.



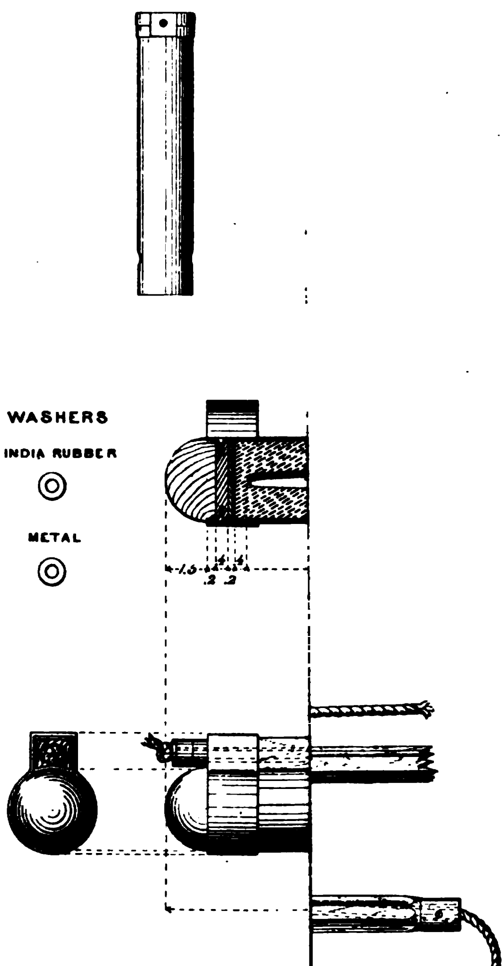
METHOD OF S



Accompanying Appendix P, 1878

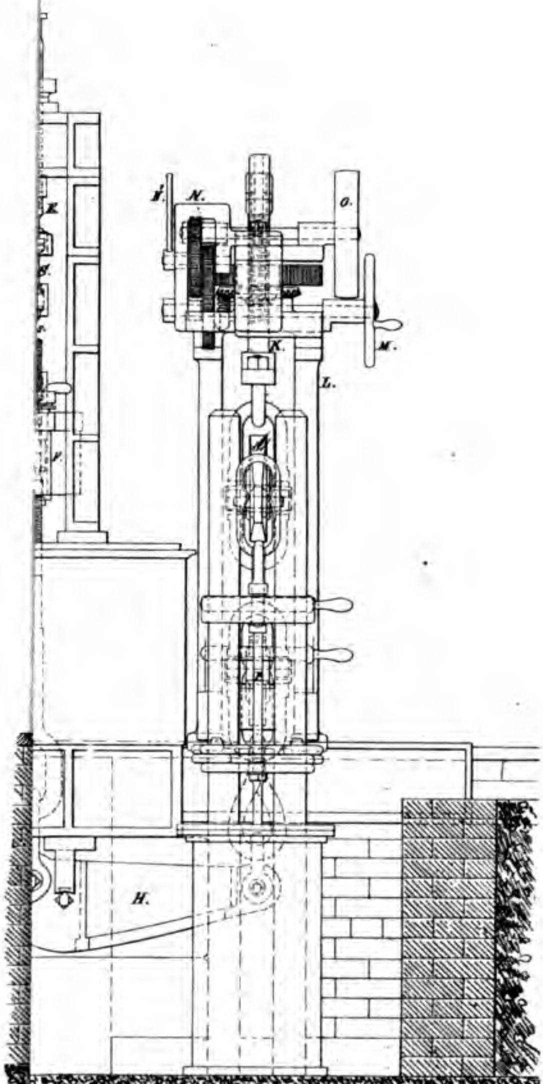
PLATE XLI.

LONG LIGHT 'UBE

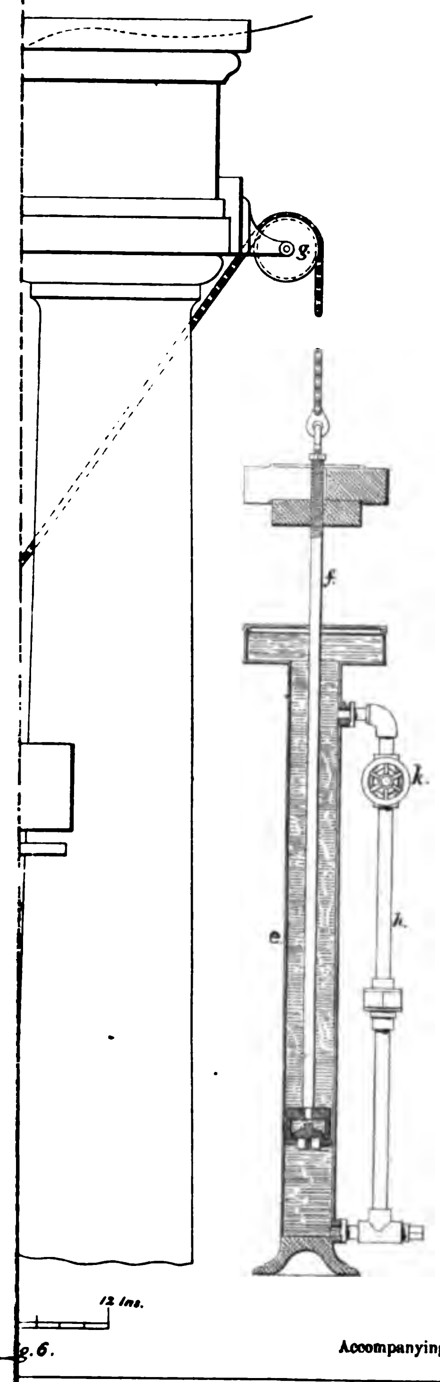


ppendix P, 1878

PLATE XLII.

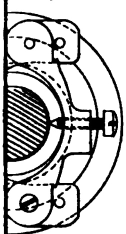


Accompanying Appendix P, 1878

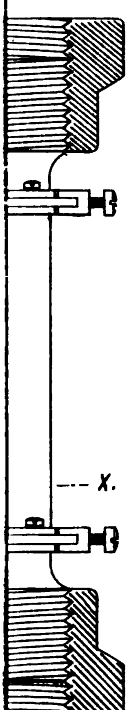


g.6.

n at X.



r. 12.



Specimen.

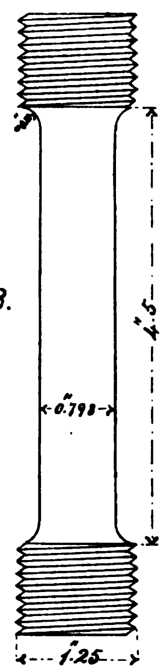
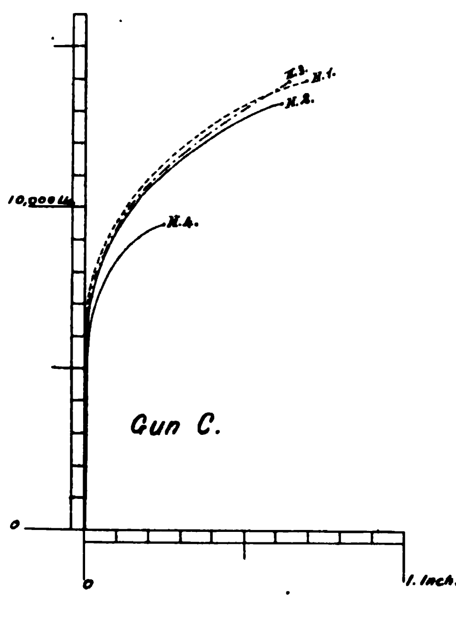


Fig. 13.

Fig. 16.



Accompanying Appendix P, 1878

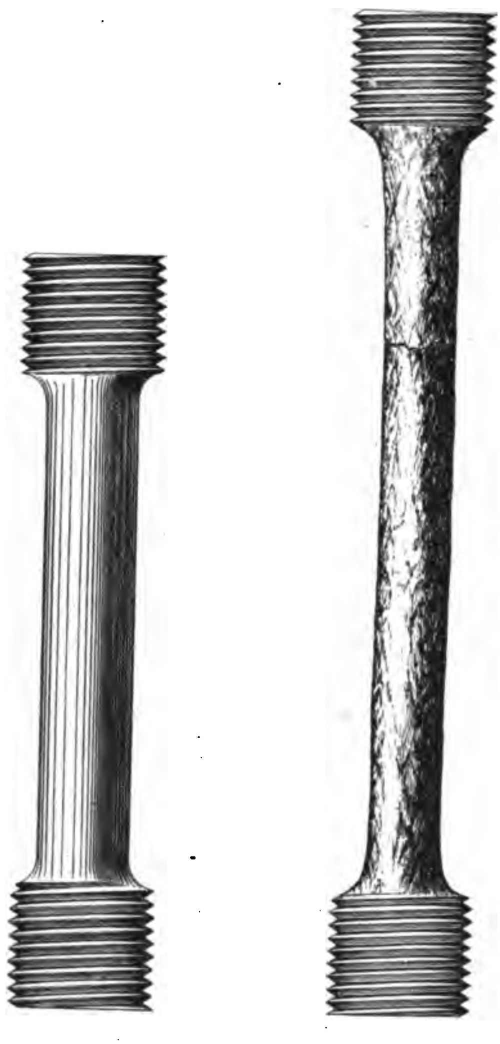
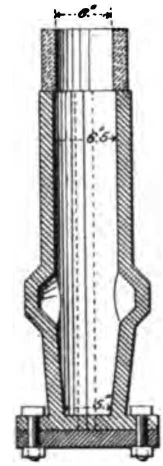


Fig. 17.

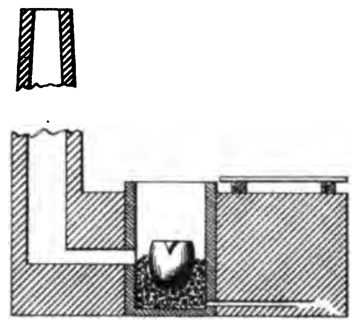
FIG. 1



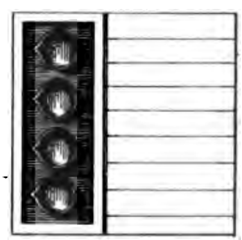
SECTION OF CHILL

PLAN

FIG. 2



SECTION OF FURNACE

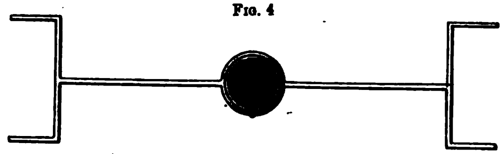


PLAN

FIG. 3

CRUCIBLE.

FIG. 4

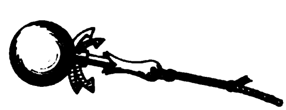


POURING LADLE.

FIG. 5

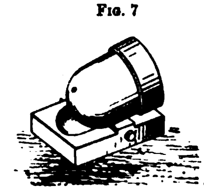
SHOT WITH LOOP
AND RAW HIDE STRAP

FIG. 6



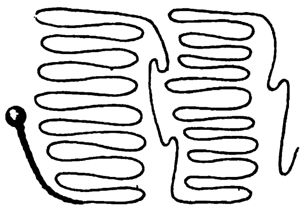
BARBED SHOT.

FIG. 7



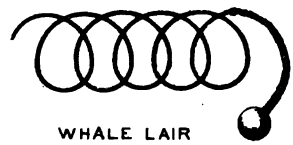
MORTAR.

Fig. 1



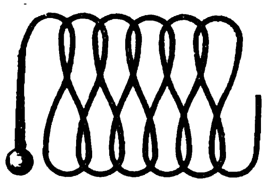
METHOD OF LAYING THE ROPE
(FRENCH FAKING)

Fig. 2



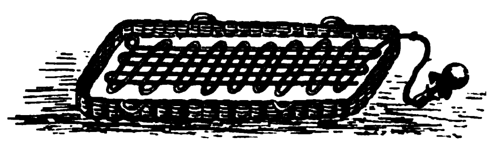
WHALE LAIR

Fig. 3



CHAIN FAKING

Fig. 4



ROPE READY IN BASKET

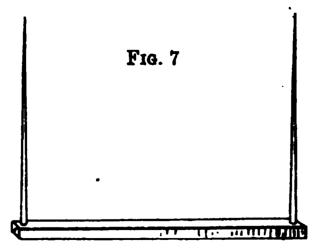
Fig. 5

PAPER TUBE

Fig. 6

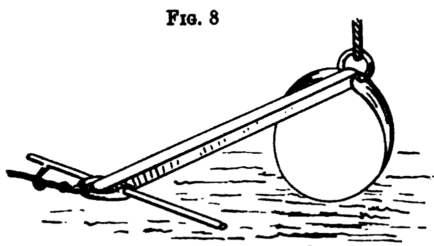
BALL WITH LID
FOR FUZE

Fig. 7



STAND

Fig. 8

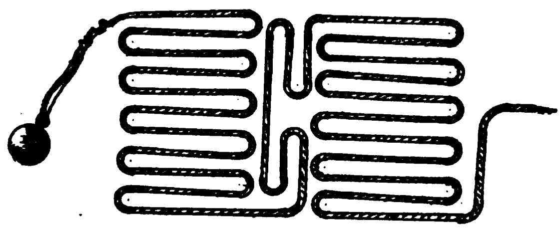


CAST IRON ANCHOR

Fig. 9

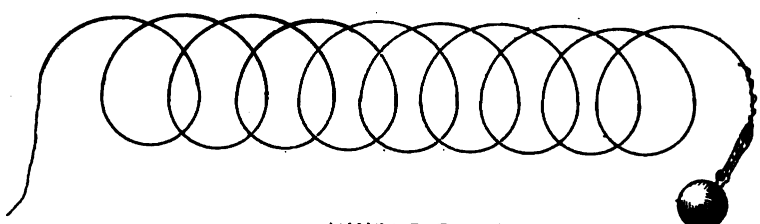
ROPE WITH STIFF LOOPS.

Fig. 1



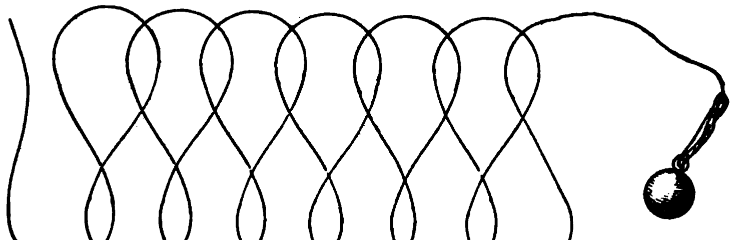
MODE OF FAKING THE ROPE

Fig. 2



WHALE FAKING

Fig. 3



CHAIN FAKING

PARROTT'S PROJECTILE.

Fig. 1

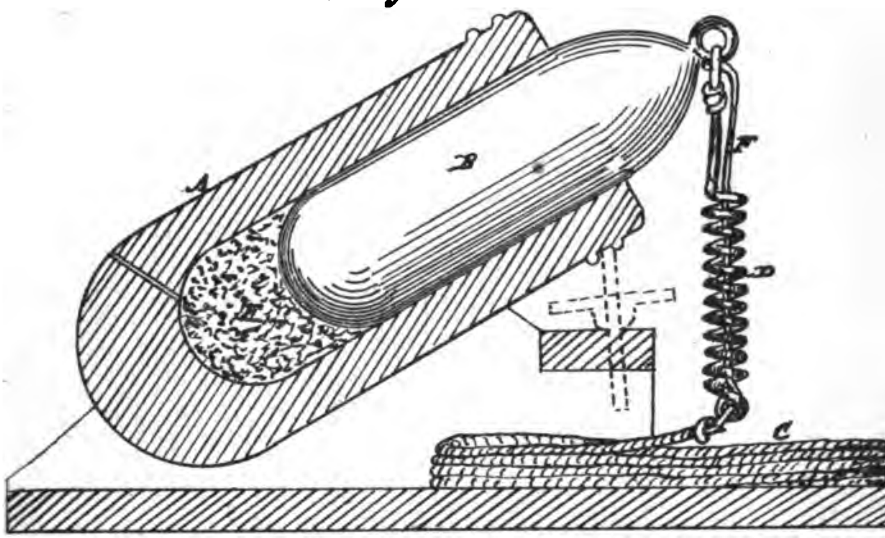


Fig. 2.

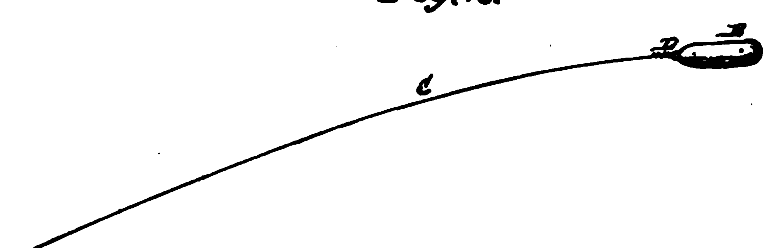


PLATE LL

E. S. HUNT.
Line-Throwing Apparatus.

No. 203,274. Patented May 7, 1878.

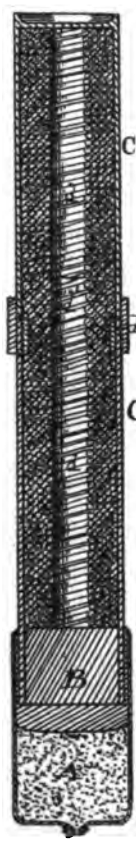


Fig.1.

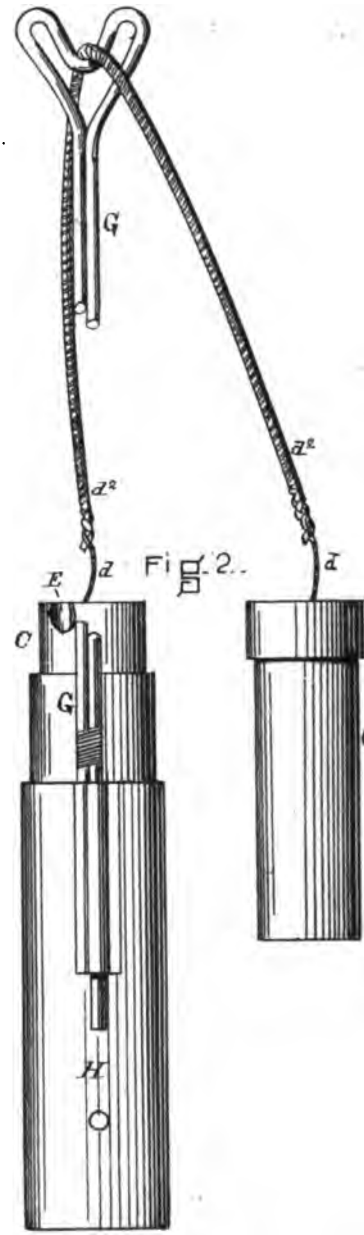
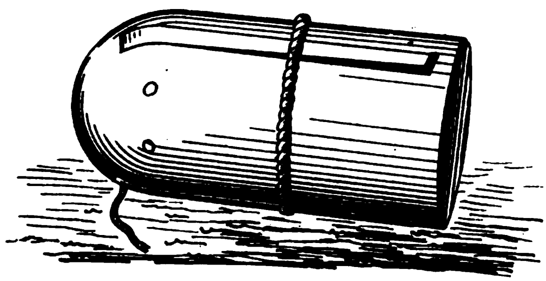


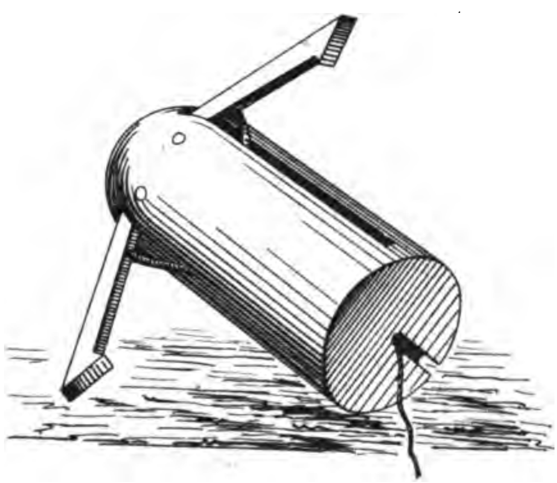
Fig.2.

Accompanying Appendix P. 1878

CHANDLER ANCHOR SHOT

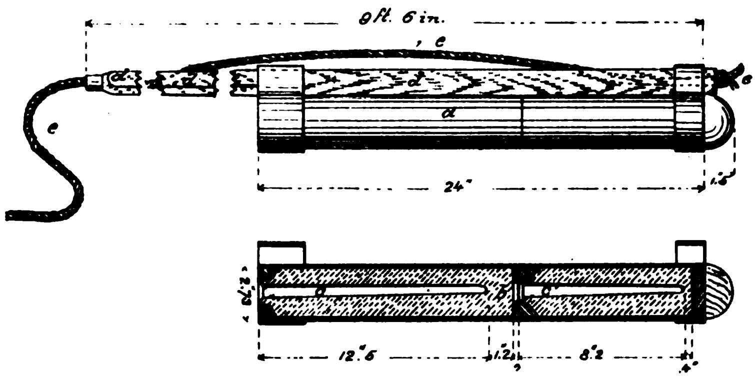


1. BEFORE FIRING



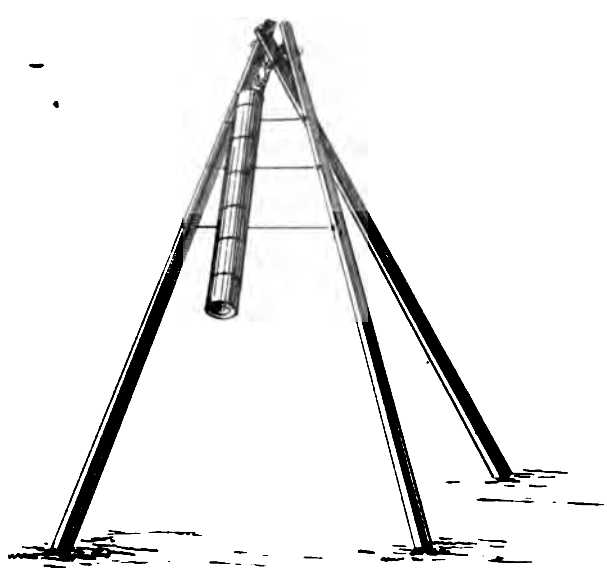
2. AFTER FIRING

FIG. 1



BOXER ROCKET

FIG. 2



LIGHT FOR ILLUMINATING WRECKS

PLATE LIV

METHOD OF USING THE LIFE SAVING APPARATUS